THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE INFLUENCE OF ENGINEERING ON RACE REMOVAL.

AN interesting passage in "The Dawn of History," by Prof. J. L. Myres, refers to some of the earlier migrations prompted by economic necessity, of the tribes which populated the Arabian desert. The effect of these nomadic tribes upon surrounding and comparatively civilised nations was profound, and led to the foundation of new sets of social conditions.

Students of modern problems concerning the races of the world will detect in more than one quarter a very similar movement at the present day, masked by certain modified modern influences, and at present only in its beginning. The ultimate result will probably be very much the same, involving changes in the geographical distribution of races, which, up to the present, have been associated with certain fixed zones, and the putting into a state of flux many of ethnological distinctions which have hitherto defined humanity.

Even at the present day we are abandoning such old-fashioned distinctions as "savage," "barbarian," and similar terms describing cultures with which we are only imperfectly acquainted, and are beginning to classify the races of the earth according to their stage in civilisation, defining them as either "backward" or "forward" nations in development. It must not be forgotten in discussing this point that some of the races which we were accustomed to regard as backward have developed a forward impetus to an extent which would be amazing if we did not remember that the seeds of modern civilisation have dropped into practically virgin soil, as illustrated in the case of Japan. Conversely, if we are to believe a tithe of the accounts which are now coming to hand during the progress of the present war, a nation which is presumably civilised is capable of acts which are crude in their savagery.

It may at first seem that all this is entirely foreign to engineering, but in reality the engineer, next to the linguist, is probably the most potent factor in this world change. He is also a man who will be most directly affected in its later stages. One or two illustrations may be given. The mission of the European nations during recent times has been to spread what is known as civilisation, which is a mode of life and the collection of tenets, and, incidentally, the sale of goods, which our particular branch of the human race has developed during a rather strenuous period of development. In spreading civilisation, the European branch has influenced other forms of civilisation, some of which antedate our own, in some cases causing trouble, while in other cases the change has been wrought without friction. One of the main causes of the Indian Mutiny was, we believe, friction between two cults which did not understand each other. A later development, however, may be noted. The railway, when introduced into India, assisted the devout Indian in his journeys to his sacred places, thus swelling the profits of the railways and fostering his own religion. The effect on the nations of India

of the introduction of the railway, an entirely engineering product, has, however, been to convert a practically fixed population with village life largely developed, into one which is rapidly becoming accustomed to the idea of travelling, with the result that Indians are now to be found in various parts of the world in great numbers. It is only necessary to refer to recent troubles in South Africa, and the deadlock which still more recently occurred in a Canadian port, to emphasise the new difficulties which the countries under our own dominion are realising as a result of this new mobile force of humanity being thrown upon the world's markets.

Humanity can be classed in one respect into two main divisions, those who are opposed to, and those who are actively engaged in, forwarding what we know as civilisation. Both are affected by the new conditions. Compare, for example, the great Boer treks with present day advantages. To quote from the earlier pages of Fitzpatrick's "Transvaal From Within," the Boers, "rich and poor, old and young, went off as in the days and in the fashion of Moses or Abraham. They went without leave or help of the Government; secretly or openly they went, and they asked nothing but to be left alone." . . . .

"Two parties, men, women and children, numbering 98 in all, pioneered the great trek. Of these, 26 survived fever and fighting, loss of provisions, wagons, and cattle, and a long weary tramp from Zoutpansberg to Delagoa Bay, and were rescued and taken thence to Natal, and two children were carried off by the natives. The survivors were three women with their 12 children—seven orphan children and four youths. Not a single grown man escaped." To-day Delagoa Bay, Salisbury, Bulawayo, and Cape Town are name-places on a railway map. With the opening up of the interior in this way, the line of frontiersmen has undoubtedly been pushed forward, and with it our civilisation; but, on the other hand, the same railway which takes the whites northward can bring the Kaffirs south. The problem of Kaffir control has always been one of the outstanding difficulties of South Africa.

Turning to other parts of the world, America and Australia cannot but take note of the growth of the Japanese, and that this growth is characterised by the utmost virility is shown by the position which the Japanese have taken in Korea, and the effective support they are giving us in the present crisis. Russia knows very well indeed what contact with another civilisation means, and in the interior of China we have the first stirrings from their age-long slumber of millions upon millions of human beings, hardened by long privations and schooled by keen-edged necessity. What will happen when the railways, acting as mobilisers to humanity, pour the contents of China across Europe and the world?

It must not be forgotten that with the railway come other branches of engineering activity and the products of these branches. Electrical engineering has transformed the standard of comfort expected by civilised nations. It would be impossible to enumerate the forces of engineering, but their sum total is to introduce to the formerly fixed and backward nations, new ideals of luxury, and therefore new cravings which cannot be satisfied by the primitive life which they have hitherto led. The result is that driven on by their new aspirations and appetites, with an easy means before them of transferring themselves to all parts of the globe, a vast movement of race is already beginning, and is likely to attain proportions that at present we do not at all realise. In this respect then, electricity, steam, and petrol are likely to play a part in changing the character of the earth's human distribution, which was certainly never realised by the engineering pioneers, and is only dimly beginning to be grasped by the average man to-day. Far-seeing statesmen have already, we believe, caught sight of the future, but it is one thing to see and another to legislate. From the book to which we referred at the commencement it can be gathered that the ravages committed by the early nomadic tribes would have been far more severe than they actually were if the Arabs had at that period in their civilisation obtained the mastery of the horse Substitute to-day for the horse the locomotive, the motor-car, the torpedo, the flying machine, the telegraph, telephone, dynamo, and motor, in the hands of men who only yesterday handled the spear and the primitive plough, and we obtain some vision of the mobilising influence of engineering on the races of the world. When we see nations which we thought were under the peaceful restraints of inter-commerce flying at each other's throats on a few days' notice, in a dispute with territorial issues, in a war so largely assisted by engineering products, one is compelled to wonder what will be the ultimate effect of modern race migration upon the world.

Lead.

The declaration of lead as contraband of war, and the reserving of important quantities of metal which were available for Government purposes, had a very stimulating effect upon the prices ruling, and private business was reported at as much as £24 a ton for immediate delivery, but this proved to be the apex, at all events for the time being, and the extent of the advance undoubtedly bred some distrust, for the general opinion was that the rise had been quite overdone. This, in fact, proved to be the case. Meantime the Metal Exchange is closed to trading, and quotations are all nominal. The early apprehensions were all in favour of an entire suspension for a time of imports of lead from abroad, but as time has gone on it has been seen that these fears lacked solid basis. British vessels can come and go practically without hindrance within the limits of all the seas, except those between here and Northern Europe, though it is true that there have been some isolated cases of the destruction of vessels on the Atlantic trade routes. The escapades of these errant German cruisers will surely, however, be circumscribed by degrees. Their object is clearly enough not to fight, but to prey on commerce and show a clean pair of heels when a British cruiser puts in an appearance, as witness the recent brush between the *Bristol* and the *Karlsruhe*. Hence no important difficulty is expected to be met with now in obtaining lead from the countries of production. There is another factor at work, however, which may exert a definite effect upon the course of values before the war is over, and that is the complete suspension of operations in the Australian Broken Hill field. The extraordinary difficulties involved in financing commercial operations is held to be responsible for this, but another possible explanation, though one mixed up with the first, is that the mines there, although British to the core, are controlled by German interests in so far as the treatment of their ores and concentrates are concerned. This introduces a new element into the position and one quite apart from all questions of finance. The fact that such an arrangement should have been in force between German and British interests has been the subject of frequent comment, and it is impossible for it to be continued after the war is over. Not only have the Australian producers indicated, suspended production, but there has been a pretty general shut-down amongst the Spanish mines and smelters, partly because of the difficulty experienced in financing operations, and partly because of the withdrawal of French engineers from certain of the works to join the colours. There is thus an apparent considerable falling off in the quantity of lead available for the satisfaction of the world's needs. Australia last year is estimated to have turned out 116,000 tons against 107,000 tons in 1912, while Spain in 1913 is credited with 202,000 tons, compared with 186,000 tons in the previous year. Too much attention, however, should not be paid to this aspect of the question, for while output in the directions indicated has been shut down, the United States mines and smelters are well engaged, and there appears to be progressive improve-

ment in Mexico. Lately again there have been plentiful offers of lead from New York, but financial conditions have been too unfavourable for any business to be effected. With a more normal rate of exchange, there is no question but that there might easily be a resumption of selling of American lead to the European markets, but this stage has not yet been reached. There are indications, too, that the Mexican production is being forced, and this is a matter of the utmost importance. For the present the extreme stringency of prices has given place to a much easier tendency, following the satisfaction of the more urgent needs. War consumption must be materially less than that in times of peace.

Coded Messages and Export Trade.

At a moment when British firms are making exceptional efforts to do business with the Colonies, it is, to put it mildly, a little hard that they should be placed so greatly at a disadvantage by the ban that the censor has had to put on coded messages. The necessity for extreme caution few will question at a time such as this, but our industrial and commercial firms which have for years made a regular practice of conducting considerable business with far-off Colonies in coded form find themselves faced with very big expense and loss of secrecy through sending messages in plain English, or possible delay if they adopt the deferred message rate. We are not surprised, now that the daily Press is devoting almost as much space to the Trade War as to the War itself, to see letters in the *Times* from several firms who feel the hardship very keenly. An East India merchant urges the reduction of cable charges for plain word telegrams, permission to use registered telegraphic addresses, and permission amongst British subjects to use codes to and from the East, as measures that would be of great assistance in "restarting the whole of commerce," so that "these money-making machines" can be utilised as quickly as possible. A firm of Anglo-Argentine exporters strongly appeals to the authorities to try and find some other way of preserving a strict censorship without prohibiting commercial code messages. It lays stress upon the importance which business firms attach to secrecy, and mentions the possibility of an ordinary clerk in a cable company's office in a far-off market disclosing the contents of a plain message to his personal acquaintances or to the competitors of the sender. The proposition is advanced that British firms of good standing and unblemished reputation should be allowed to continue coding their cablegrams, if necessary under a guarantee given by, say, two other similar firms or bankers. He suggests that "a signed literal translation of each message might accompany it for the censor's information on this side, and replies received in code might be decoded by the addressees in the censor's office before delivery. The code would, of course, be produced whenever required, but the multiplicity of private codes would make it impracticable to file a copy of each in the censor's office." We have no doubt that these suggestions have already come under the notice of those responsible for the duty of censorship. While under existing circumstances we can hardly be too careful, it seems to us that, with suitable safeguards, facilities might be granted to the hundreds of firms of unquestionable reputation in the business world who are known to the cable companies to make a regular use of certain codes in time of peace. But if for national reasons the ban cannot be removed, is it unreasonable to suggest that it would be an act of loyal co-operation with commercial firms in keeping industry in operation if the great cable companies were to accept a much reduced fee per word from those who are well known to them as having temporarily to abandon their usual methods, and who are obliged to cable messages in detail? Much of their traffic has only been built up because codification has been possible, and consideration to their regular customers at this juncture might not come amiss.

War and Trade.

Reports that are coming to hand from the great engineering centres of the kingdom give little occasion for gloom. It was inevitable that so great a shock should overwhelm most things for a time, but after recovery from the first effects those responsible for the industry have calmly and confidently endeavoured to accommodate themselves to the altered state of affairs, making necessary adjustments here and there. From some of the manufacturing districts comes the news that electrical works are already receiving business from both home and abroad which would not have come to them a month ago. The feeling seems to be fairly general that as soon as matters become more settled, and insurance and freight rates are lowered, our electrical firms will have a very busy time. In the Manchester district, as, indeed, almost everywhere, a certain lack of confidence still makes itself felt, and the atmosphere is not improved by the fact that the mills are on short time or closed.

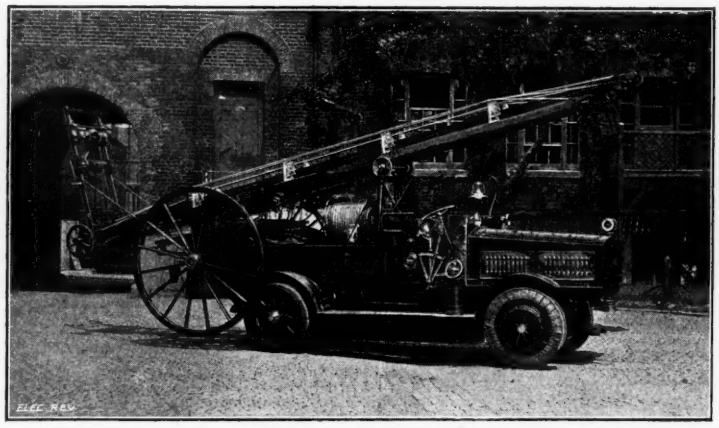
Some firms in the neighbourhood of Manchester are, of course, busy with Government work—the making of shells among other things. The *Manchester Guardian*, in discussing the position, says that in spite of the rush of engineering artisans to the Labour Exchange, the engineering position is wonderfully good, and has fair prospect of remaining so, or even improving. At the moment employment is very unequal, and any approach to uniformity cannot yet be expected. Some works which, caught in the early panic, took drastic measures to reduce working hours and staff, have found that their action has not been justified by the subsequent course of events, and they are now returning to more normal conditions of working. "In some cases the reductions were in part due to the action of some banks in restricting withdrawals. This restraint is now easier, and if the braking action of the moratorium can be removed, will largely appear. There has been a marked revival in general confidence, and consequent inquiries in connection with new business. This hopeful tone is a most welcome indication of business prospects during, perhaps, the next six months." The writer goes on to state that electrical engineers and steelmakers are foremost among those who are feeling the advantage of the withdrawal of German competition.

From various directions we are receiving inquiries asking where it is possible to obtain in England or in neutral countries particular lines of electrical manufactures previously obtained from Germany. We print several such inquiries in our "Notes" pages to-day. We shall do our best, both privately and by publicity, to assist to bring together the willing British manufacturer and the seeking customer—that is one of the great objects of our life, as a paper, and always has been so, but we believe that the existence of this inquiring spirit will prove to the trade, if any proof were necessary, that at this stage it is more important than ever that the manufacturing ability and resources of the British electrical industry should be given the fullest possible publicity, special emphasis being laid upon any particular capacity for handling new and special lines. Trade and other journals have their own trials at this time. Mr. Thomas Russell, the president of the Society of Advertisement Consultants, said the other day that the paralysis of industry and the slump in advertising were due to panic. He expressed the view that the only way to get confidence back was by advertising, and that everybody who ceased advertising was creating unemployment. Mr. Gordon Selfridge, who is conspicuous among general business men for maintaining his advertising, says that he is not just now doing business for profit, but "to hold the nation together." Electrical firms by keeping going as fully as possible are, as we have already stated, assisting the nation, but they are also in the position to help themselves in some directions by availing themselves of newly-opened opportunities such as we have mentioned above. This should be a powerful inducement to them to keep themselves in the full glare o the footlights.

SOME NOTES ON THE ELECTRIC VEHICLE EQUIPMENT OF THE LONDON FIRE BRIGADE.

Following the information we were able to publish in the Review of August 14th with regard to the fleet of electric motor vehicles used by the Fire Brigade of Berlin, and the running and maintenance cost of the same, we are this week able to give some up-to-date details with regard to the motor equipment, and more particularly of the electromobile portion of the same, of the London Fire Brigade, the area under the protection of which, according to the paper read last year by Divisional Officer A. D. Dyer, A.M.I.C.E., before the International Association of Fire Engineers, in New York, extends to no less than 117 sq. miles.

As was pointed out in our Berlin article, the German authorities devoted considerable attention to the question of the best form of motor fire engine, and have finally decided in favour of electrically-propelled vehicles, fitted with petrol-actuated pumps, some petrol-electric machines being also used. In London, machines in which the same petrol motor is utilised both for vehicle propulsion and pump-operating purposes have been chosen, and although the early trials were not very successful, the progress made by petrol fire engine builders has been such that a high standard of efficiency has now been reached, the modern machines being fitted with large engines, developing 65 H.P. at 1,100 revolutions, and centrifugal pumps having an output of 500 gallons per minute, at a working pressure of over 120 lb. per sq. in.



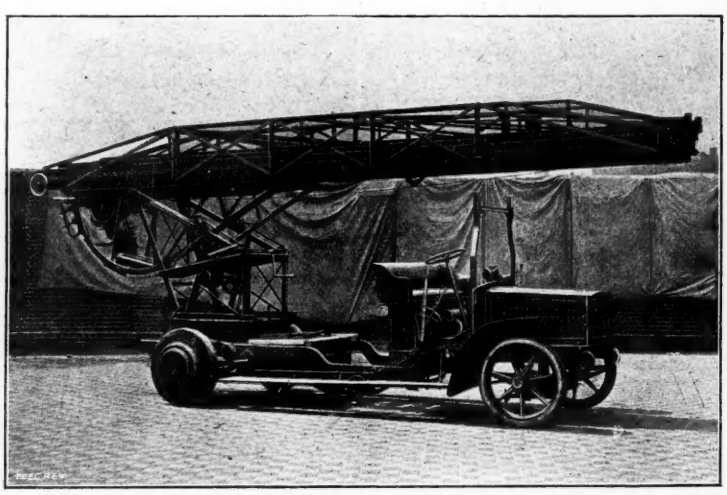
Electric Escape Van; London Fire Brigade.

With regard to the petrol motor escape vans, the first supplied only gave moderate satisfaction, as manufacturers generally, had had no experience in the running of vehicles weighing, with load, about 5 tons, at speeds exceeding 20 miles per hour. Indeed, prior to 1910 it was considered necessary to have one spare petrol escape van for every one on duty, in order to maintain an efficient service, whereas now, only one spare in five escape vans or pumps is deemed necessary.

Later some trials were made with electrically-propelled escape vans, these proving so satisfactory that eventually it was decided to adopt them, in a measure, as a standard for life-saving appliances in localities where the gradients are moderate. In the more hilly districts of London the stations are equipped with petrol-motor escape vans, fitted with engines of about 50 H.P., some petrol-electric vehicles, that is, machines with petrol engines as the prime mover, with electrical in place of mechanical transmission of the power to the road wheels, being, also, now on order.

The first electrically-propelled fire appliance was put into service in London in February, 1911, or about 3½ years ago. At the present time the London Fire Brigade has a total of 15 such vehicles, 11 being officially designated as escape vans and four as motor turntable ladders. Including the headquarters of the Brigade in Southwark Bridge Road, three stations are provided with two electric vehicles each, the remainder being allotted singly to different stations.

One of the vehicles is known as the Simonis, but the majority are of the Cedes type. The latter are equipped with series-wound motors mounted in the hubs of the front road wheels, which are thus driven direct without the intervention of any gearing, the Cedes Co. claiming an efficiency of from 78 to 85 per cent. for their motors, which are rated at 15 electrical H.P. The power is provided by a battery of 84 Tudor cells of a capacity of 200 ampere-hours at a 6-hours' discharge rate, giving a normal running output of about 30 H.P. The cells are carried in trays, either under a bonnet in the front of the driver or just to the rear of the forward wheels below the driver's seat. The machines can run about 30 miles on one charge if necessary, but owing to the nature of the service they stand fully charged ready to give out the maximum output on receipt of a call. There are electric brakes on the front wheel motors, which are valuable in emergencies, whilst two hand and foot controlled mechanical brakes on the rear wheels are sufficient under ordinary circumstances. The controller is of the series-parallel type, with seven notches for three forward speeds, two reverse motions and two brake positions. All the contact fingers of the controller are interchangeable and can be removed without the use of any tool. The danger of burning out of the device is thus avoided, for should a finger burn out, it can be replaced by another in two or three seconds.

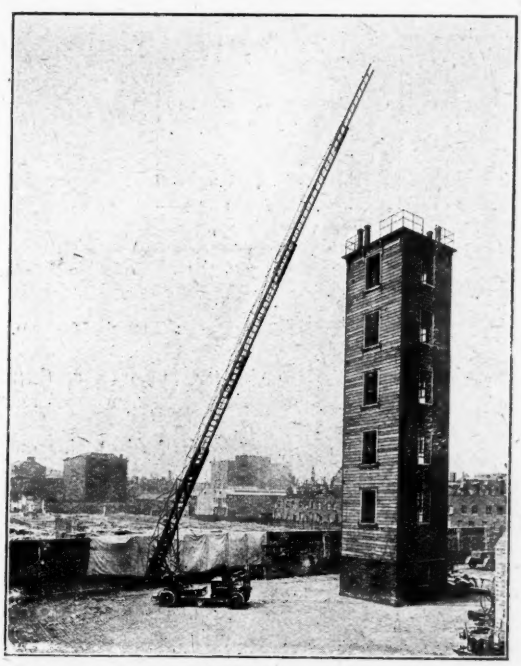


Simonis Electric Turntable Ladder; London Fire Brigade.

The weight of an electric escape van ready for running, but without ladders, hose, and small gear, and men, does not exceed 3¾ tons, the total weight of the van complete being about 5¼ tons. The test requirements of the electric escape vans are that they shall be able to maintain a speed of 25 M.P.H. on the level with a full load of ladder, equipment and firemen, or 29 M.P.H. with men and equipment, but without ladder. They must be able to climb a gradient of 1 in 20 at 14½ to 16 M.P.H., while the battery must be capable of enabling a distance of 30 miles to be run on one charge at 20 M.P.H. In practice, these speeds can easily be exceeded, from 28 to 29 M.P.H. being reached on the level, with plain tires, and from 26 to 27 M.P.H., when non-skids

are fitted. The escape vans carry a ladder capable of being extended to at least 50 ft., and are also furnished with supplementary ladders, hose and tools for getting to work from hydrants, and a cylinder holding about 30 gallons of water, fitted with 180 ft. of rubber garden-hose for extinguishing small fires. This type of appliance, the crew of which is on duty night and day, is ready for an instantaneous turn-out, and only attends fires on the ground immediately protected by the station, the distance it may travel to fires rarely exceeding one mile.

The electric motor turn-table ladders are kept at the stations in localities where there are many high or warehouse buildings. These appliances, whilst intended, generally speaking, for attending local calls, are considered available in case of serious fires in high buildings within a radius of about five miles. Owing to their weight, which, complete in fire-attending order, ranges from $5\frac{3}{4}$ to 6 tons, it is not considered necessary to specify that the electric motor turn-table ladders, which can be safely used as water towers to a height of 60 ft., shall travel at more than 20 miles per hour, but with plain tires they can attain 27 m.p.h., or, with non-skids, 25 m.p.h. Several of these machines are fitted with 5-h.p. electric motors for raising the ladders, some to a height of nearly 100 ft., an operation which is accomplished in the rapid time of 10 seconds. The



Fully-extended Turntable Ladder, London Fire Brigade.

motor, which takes its current from the vehicle battery, serves as a brake when lowering the ladder. One of the accompanying illustrations shows an electric motor turntable ladder in its travelling position, while another depicts the same machine with the ladder extended.

From the introduction of heavy motor fire-fighting machines capable of high speed, the problem of providing some satisfactory means of preventing skidding has, as has been the case in Berlin, been the cause of considerable study and experiment. Some mitigation of the difficulty was secured by utilising chains festooned diagonally across the tires, but considerable damage was caused to the rubber, which, when worn, allowed the chains to come in contact with the steel rims. This caused the non-skid chains to break, and allowed the loose ends to tear the mud-guards. Other devices were tried to check the tendency to skidding, such as studded leather covers and transverse bands of steel-studded balata belting fitted into slots cut into the rubber of the tire. The latter were found to be most effective when the tires and bands were new, but gave endless trouble when partly worn. One appliance has run for a year without non-skids, but with soft rubber tires of flat tread and extra wide section, single on front wheels and twin on rear wheels. Although no skidding has taken place, there is still some doubt if motor fire brigade machines can be safely run under all conditions in London without some non-skid attachment. Mechanical front wheel brakes were tried on the appliances supplied by different manufacturers in 1910, in order, it was hoped, to obviate the effects of skidding, but whilst satisfactory results were obtained on tests they were found unsuitable in practice, and have now been removed, rear wheel or differential brakes having been fitted in lieu.

The difficulties with regard to skidding formerly experienced have, however, now been fairly overcome; first, by careful training and the continued experience of drivers; secondly, by allowing greater cross-section in tires, 5-in. solid rubber being now used; and thirdly, by using extra heavy leather steel-studded covers fitted on two wheels only —on the off-side front wheel and the near-side rear wheel— this corresponding exactly with the practice now followed, after similar experiments, in Berlin.

The batteries are looked after by the Brigade staff alone, and, so far, have proved very satisfactory. Indeed, the battery maintenance costs have up to the present time been restricted to the renewal of the positive plates of the accumulators of one vehicle only. It may, therefore, be said that costs under this heading are only just commencing, but they are not expected to be heavy, as the officials report that by properly looking after them, they anticipate no trouble. No spare batteries are kept on hand, but, of the fleet of 11 escape vans, two are always held in reserve to take the place of any temporarily out of service at any of the stations. No spare electric motor turn-table ladder is at present available.

Current for battery charging is taken from the public supply mains in the district in which the stations are situated, the rate paid ranging from 1d. to 2d. per unit. Like most users of electric vehicles, the Brigade has experienced difficulty in getting current at a suitable voltage. Only about 30 amperes is required for the batteries, and the maximum voltage is 240, but very few electric supply authorities in London furnish current under 400 volts, and, therefore, either a good deal of current has to be wasted in charging, or a motor-generator set must be put in, the latter meaning a considerable expense.

Whenever an electric vehicle goes out, its battery is immediately put on charge on its return, each of the stations being equipped with charging boards and leads to enable the charging operation to be carried out without trouble, and with the vehicle in position for immediate service. Hitherto it has been the practice to discharge the batteries down to 1·9 volts, and re-charge them once a month. This operation is done by actually running the vehicles on the road in the neighbourhood of the stations, and as no indications of sulphating have been detected, it has been decided to increase the intervals of discharge and charge to six weeks; this will mean a slight decrease in the annual cost of current, which at present amounts to approximately £8 per vehicle.

(*To be concluded.*)

ELECTRICITY SUPPLIES FOR KINEMATOGRAPHS.

By W. B. S.

(*Concluded from page* 271.)

The Electrical Company's auto-connected motor-generator also has its motor field and dynamo field connected across the supply pressure, but a shunt regulating resistance to vary the arc voltage is connected in series with the generator field as in fig. 7. As in the "Macfarlane" machine, no line resistance is necessary, thus minimising the losses on the set. Fig. 8 shows the connections for the same firm's rotary converter, which consists of one armature with two windings, and two commutators, but only one field system, the latter being connected across the supply pressure. No regulation of the arc voltage is possible with this machine, so that a

variable line resistance must be connected in series with the arc.

Messrs. Crompton & Co. have had on the market for many years a converter suitable for searchlight work, and this

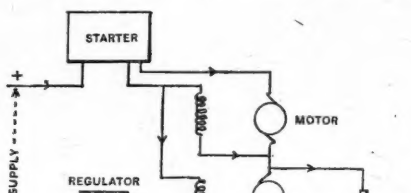


Fig. 7.—Motor-Generator (Auto-connected); Electrical Co., Ltd.

machine, known as the "C.M.B. converter," has been adapted for kinematograph purposes where the ratio of conversion is small. The connections are indicated in fig 9. A single armature and specially large commutator are used, and these revolve within a single field system having two sets of field coils, and two pairs of brush gear. These series windings oppose the shunt windings so that a drooping characteristic curve results as in fig. 6, p. 271. This machine is self-regulating within limits, the small shunt regulator being

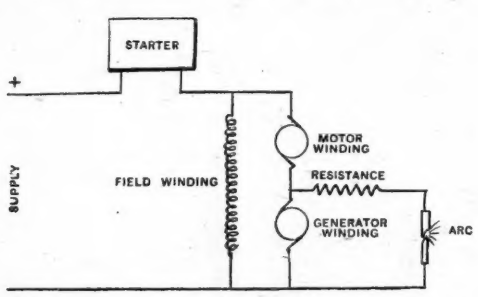


Fig. 8.—Rotary Converter: One armature, two windings, single field.

connected to one of the special windings to enable the current to be reduced to any value to suit the film in the lantern. A line resistance is not required.

It is well known that an arc run from an alternating current supply gives rise to excessive flickering and consequent "dancing" of the pictures, and, where possible, the

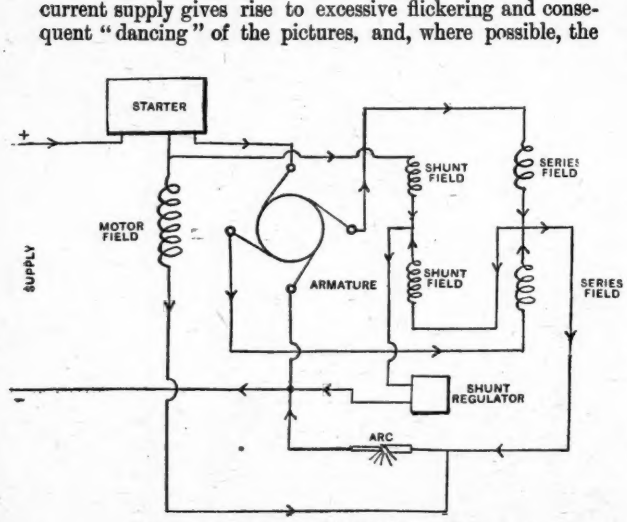


Fig. 9.—Crompton C.M.B. Converter.

alternating current should be converted to direct current. Motor-generators constructed of A.C. motors coupled to D.C. generators are often installed, while, in other cases, rectifiers are used. The electrolytic rectifier is an adaptation of the "Nodon valve" shown in fig. 10.

The method consists in employing four rectifiers per phase, coupled in such a way that both halves of the supply wave are utilised. The four cells in the diagram, C_1, C_2, C_3 and C_4, are made up of lead-containing vessels, each containing a rod of aluminium alloy and an electrolyte of ammonium phosphate solution. Under certain conditions of potential difference, the cells exhibit a greater resistance to the passage of current in one direction than in the other. A low resistance is offered between the lead (the anode) and the aluminium (the cathode), so that an appreciable current passes in this direction only, through each cell. The cells are therefore connected in such a manner that the two left-hand cells are in series, and they are connected in parallel (but with poles opposed) to the two right-hand cells, which are also connected in series. The alternating current is fed in at the centre points E and F of each of the pairs of cells, and the direct current is drawn from the junctions C and D of the parallel arrangement. Consider a current leaving the transformer by the terminal A at some instant; since the cell will only allow current to pass from lead to aluminium, the current will pass through C_2, then through the direct-current load and back to terminal B by way of C_4. An instant later the current has reversed, and leaves

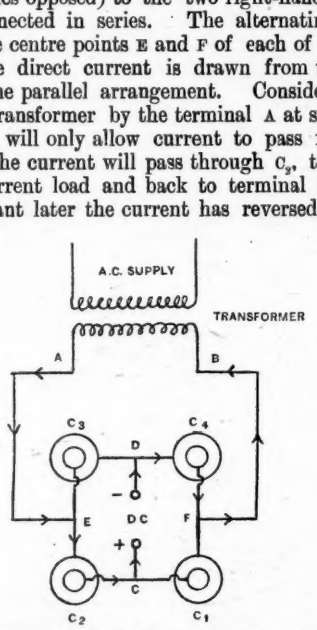


Fig. 10.—Electrolytic Rectifier: Gratz's Method.

the terminal B of the transformer, traverses C_1, then the direct-current circuit in the same direction as before, and returns to terminal A through C_3.

The mercury arc rectifier depends for its action on the property of ionised mercury vapour of conducting electricity in one direction only. The rectifier is usually in the form of a glass container, into which are sealed two iron or graphite anodes and one mercury cathode, and one starting electrode. The container is filled with mercury vapour. To ionise the vapour the mercury in the cathode and starting electrode are brought together and separated by tilting

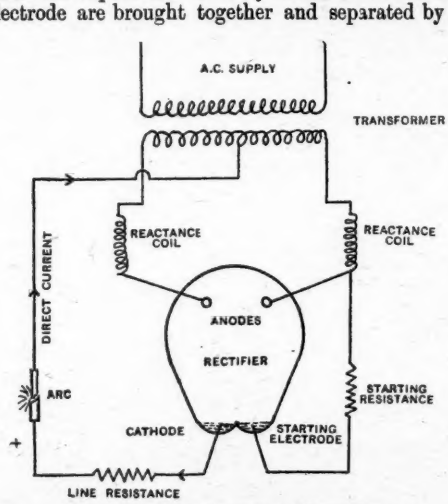


Fig. 11.—Mercury Arc Rectifier.

the container, thus drawing an arc. When this has been done, current will only flow from one of the anodes to the cathode and not in the reverse direction. In order to maintain the action, a lag is produced in each half-wave by the use of a reactance coil, and hence the current never reaches

its zero value. Fig. 11 shows the connections for a mercury arc rectifier for a single-phase supply. They may also be provided with three anodes for three-phase supplies; 15 to 25 volts drop takes place in the bulb, and the energy lost thereby is transformed into heat and a light is emitted. The light is sometimes made use of for display purposes outside the cinema building. The efficiency of the mercury rectifier varies from 50 to 90 per cent., and the difficulties attendant on its use are leakage from one anode to another, and the maintenance of vacuum in large sizes of bulbs. A line resistance is inserted in the direct current circuit to regulate the supply to the cinema arc. Bulbs are manufactured suitable for a current of 30 or 40 amperes, and for larger currents several rectifiers are connected in parallel. The operation of the rectifiers is noiseless, and the life of the bulbs averages 2,000 hours, so that spares require to be kept in readiness for emergency.

As a motor-generator or a rectifier requires attention from time to time, its reliability cannot be entirely depended on. It is therefore wise that a stand-by plant should in all cases be installed in case of breakdown. This may take the form of a second motor-generator or rectifier, a resistance frame, a secondary battery or a gas engine generating set.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electric Cooking Apparatus.

I trust you will forgive me taking up a little of your time and space in your journal. The matter is in relation to the radiant controversy over a conundrum, *i.e.*, the Venner cooker.

I should be indeed sorry to take our readers back over the disputed ground. It would be much too painful and enervating. What I should like answered regarding the Venner apparatus has neither to do with radiation, gastronomical science, nor even the oil vent. The question is, and it has been overlooked, the renewal of the elements in the case of breakdown (we will not call it a burn out).

According to the description of the cooker the only access to the oil chamber containing a film of oil and unit is through the oil vent, the other parts of the apparatus being sealed. Is it proposed to revert back to the ancient Egyptians, and inject a fluid into the oil chamber which would dissolve the element, the whole being withdrawn through the vent in the same way that the Egyptians dissolved the matter in dead bodies before embalming?

Of course, some people may suggest it is quite an easy matter to cut away the bottom of the vessel, replace the element and solder a metal disk in position, but with oil at a temperature of 460° F., with a possibility of running up to 600° F., I think I should feel more secure in purchasing a new cooker in place of renewing the elements.

Therefore I shall feel happily delighted if one of your readers can enlighten me on the above matter.

Ptah.

Melbourne, *July 14th*, 1914.

[We fail to understand the fourth paragraph of the above letter. Would our correspondent renew a burner on a gas stove with the gas on?—EDS. E.R.]

Wireman or Electrical Fitter?

The City and Guilds Institute have done much to improve the examinations in electric wireman's work, as last session's papers prove, but there is ample scope for bringing the syllabus more into line with the requirements of this branch of the profession. In view of this fact, I would suggest that domestic and intercommunication telephones should be included, as most contractors have to tackle telephone installations at different times, and they expect their wiremen to be able to install such apparatus, to locate faults, and if possible to remedy same. The practical classes would help the men considerably, and the class room could be utilised to explain necessary details, as regards principles of construction, fault localising, testing, &c.

There is one other point I should like to raise, and that is the question of title. The word "wireman" as applied does not, in my opinion, do justice to the skilled artisan who is entrusted with the numerous details encountered in present day electrical installation work. The definition is too narrow. Especially where the individual has succeeded in passing the C. and G. exams. and obtaining the "Full Technological Certificate in Electric Wireman's Work."

I suggest that "electrical fitter" is more appropriate, and that the subject in the C. and G. prospectuses should be entitled "Electrical Distribution, Fitting and Wiring." An analysis of the final paper of last session would justify this description. It would be interesting to have other readers' opinions on the above.

El-Les.

Leytonstone, N.E.

WAR AND THE ELECTRICAL INDUSTRY.

[AMERICAN VIEWS.]

IN the course of an Editorial on the outbreak of war and "America's Hour of Opportunity," the New York *Electrical World* says:—

"A number of bankers in New York's financial district have expressed almost unanimously the opinion that the outlook for American electrical securities was never better. The effect of the war in Europe, in their opinion, will be extremely favourable to the electrical industries of America. These are not shallow opinions. They are the beliefs of men who are accustomed to back their views with money. Certainly there will be no decrease in the lighting load. There may be some slight temporary decrease in the demands for motor service here and there, but not much, if any, is looked for. On the contrary, a growth in energy consumption in the next few months is confidently expected after conditions readjust themselves, as they surely will. Important as they are, these things are of small moment compared with the tremendous possibilities that the immediate future holds for America, particularly for every branch of the electrical manufacturing industry in this country. Such an opportunity as now presents itself has never arisen before, and is not likely to do so again for generations. Now of all times is the occasion for the United States to become supreme in the markets of the Western Hemisphere, and of the rest of the earth that is not at war. For the last quarter of a century Germany has been labouring mightily, and with success, to establish markets for her goods, especially throughout Latin America. Moreover, since our new tariff went into effect, the Germans have been planning a commercial invasion of the United States. With Germany at war with its neighbours on all sides, the threatening conditions have ended. To-day the United States is in the most favourable position in the world—rich, self-supporting and at peace. The Panama Canal will be opened for commerce this month. We have a new banking law that is especially designed to foster our export trade. The temporary reduction in the prices of electrical securities furnishes no cause for alarm. The real values are unimpaired. There is no ground for worry. On the contrary, there is every reason for hope and none at all for fear."

In a second article, on the effect of the conflict on electrical manufacturing, our contemporary says:—

"The great struggle which is now progressing on the other side of the Atlantic has tied up the export trade of the electrical manufacturers of this country. The General Electric Co. exports monthly electrical apparatus and equipment with an approximate value of £200,000. At the present time this company has goods valued between £60,000 and £80,000 somewhere on the seas. The Westinghouse Electric & Manufacturing Co. does only a nominal export business. For the most part its patent rights in Europe have been purchased by local companies. Its South American trade, however, is large and has suffered. At present there are in New York City, 150 cars loaded with freight from the Westinghouse Co., and more follow each day. This freight, consigned to South America, cannot be delivered until some means of passage by water has been provided.

"At the New York office of the Westinghouse Co. it was stated that of the company's subsidiaries in England, France, Italy and Austria, only the British company pays any dividends to the American company. These dividends amount to about £17,000 a year. This, then, in case of an entire shut-down of its European branches is the most the Westinghouse Co. would lose from that cause. The other subsidiaries pay no dividends to this country, and the Russian company is now practically liquidated. Mr. Tripp, the chairman of the company, is now in London, but the New York office has had no advices from him. The General Electric Co. has no subsidiaries on the Continent of Europe, and its only interest abroad lies in its control of the British Thomson-Houston Co. This last company, however, has not been paying dividends, and at times has needed help from the home company. The General

Electric Co. sells its American products to foreign firms and thus creates a market. Therefore, its only loss in Europe would be in the purchase price of the British Thomson-Houston Co., and in the absence, for the present, of a European market.

"Far more serious than the interest in foreign companies, however, is the export trade. With commerce blocked owing to the fact that Europe owns the merchant marine, it is, at least for the present, impossible to send merchandise out of this country.

"There is one bright spot in the midst of all this threatening disaster. Those countries in whose control the merchant marine now lies are at war—England, Germany, France and Russia. In this age commerce cannot be completely stopped. Thus it would seem that the United States must find some means whereby exports shall be moved.

"Moreover, South America has largely been supplied with electrical equipment by Germany and Austria. There are none left now to supply the South American demand but our own manufacturers. While our companies will probably not increase their gross income from sales, owing to the inaccessibility of capital, nevertheless during hostilities they will supply a much larger percentage of equipment and apparatus. Time alone can tell to what extent they will be able to retain that trade once acquired."

The American *Electrical Review* writes as follows:—"The foreign commerce of European nations participating in the war is likely to be entirely paralysed, and, indeed, seems to have already ceased. . . . The electrical export trade of the United States will necessarily be affected, and, probably, in two ways. Exports to Europe will largely be suspended, but this should be more than made up by the opportunities for disposing of American goods in other parts of the world. Our principal competitors in electrical supplies have been Germany and England, and their trade with other parts of the world must be seriously crippled by the present conditions. There should be an opportunity, then, for American manufacturers to make advances in South America, in the Orient, and in other territory which has previously been supplied by English and German manufacturers. The principal electrical exports of the United States consist of generators, motors, transformers, telephones, wire and cables. But little of this material has gone to Europe or to English and German Colonies, especially the latter. Interruptions to this business should, consequently, not be so serious as might at first seem likely. Even if England or Germany, through decisive naval victories, should be able to maintain its commerce upon the high seas, the uncertainty of delivery would be very influential in directing orders to this country. . . . One of the most serious effects of the war upon the electrical industry in this country is likely to be felt in the lack of capital for new enterprises. The investment of European capital in this country will undoubtedly cease, and, indeed, has already done so."

BRITISH-MADE MAGNETOS FOR BRITISH MOTOR-CARS.

An Appeal to British Motor-Car and Magneto Manufacturers.

In view of the outbreak of the long-dreaded European War, the petrol motor-car industry of Great Britain finds itself in an extremely awkward position. For some years practically every motor-car manufacturer has been using for ignition purposes a magneto, principally of foreign manufacture—and chiefly German at that—with the result that to-day all deliveries from the manufacturers are cut off, the supplies being restricted to the relatively small quantities held in stock by the representatives or agents of the makers in this country.

Our manufacturers of cars "have only got themselves to blame," for even the motor Press has previously drawn attention to the dangerous position. Thus, in December of last year, under the heading, "A Magneto Monopoly," the *Autocar* published an article which to-day has an added interest and significance. The article in question was instituted by the numerous complaints that had been received with regard to the high prices charged for magneto spare parts, and for repairs, and, while dealing with this phase of the matter, our contemporary took the opportunity of drawing attention to the position British motor manufacturers and traders and also motorists, might be in should labour disputes or strikes occur in the principal centre of the magneto industry.

As was then pointed out, "at the present time one town, Stuttgart, has what to all intents and purposes is a monopoly of the magneto manufacture for British cars; that this is so will be recognised when we say that in Stuttgart the Bosch, Eisemann and the Mea magnetos are made. True, these are not the only magnetos to be found on British cars, but they are so overwhelmingly in the majority, that if the statement were made that all British cars had German magnetos, and all German magnetos came from Stuttgart, it would be so nearly the truth that it would not be worth disputing. This is a really dangerous position, because of the possibility of labour disputes and strikes, as such things may well occur when a trade is so centralised as this one appears to be."

Needless to say, the position, now that war has broken out, has become a much more serious one than would be engendered by strikes, and is one that will undoubtedly give rise to much study. While every credit is due to the German magneto manufacturers for the way in which they established their reputations and businesses, there appears to us no valid reason why we should continue to be dependent on foreigners for our ignition apparatus; indeed, we consider it to be far from creditable to the British motor industry as a whole that this should be the case.

It would take too long to inquire into the why and wherefore of the fact that no British firm has hitherto tackled the magneto business in a really big way. Perhaps it is that none have been sufficiently enterprising, and perhaps it is that British motor manufacturers have not given any encouragement to home firms, but have been too prone to follow the lead in using certain makes of magnetos. Whatever has been the cause, the time has now arrived when a change must be made; when motor manufacturers must no longer be dependent on any foreign country for so vital a part of motor-car mechanism as the magneto. The war is demonstrating what has for some years been realised, the great and indispensable part which motor vehicles now play in military operations—in the rapid conveyance of troops, in the hauling of big guns, in transport work generally, in the commissariat department and in ambulance work, and, in view of such condition of things, it has become of national importance that every necessary part of a motor-car's anatomy shall be capable of production in our own country.

While everyone will admit that reliability and accuracy of manufacture must be associated with the products of those who have specialised on magneto manufacture for many years, and who also, having had the advantage of a large and steadily increasing annual production, have been enabled to train up an army of specialised workmen, and, at the same time, to reduce costs of production to a commercial footing, yet we cannot conceive that in these days of advanced electrical engineering knowledge, there should be any serious and insurmountable difficulty in developing some of the existing British magneto manufacturing businesses to such an extent that they will be able to cope with the demand for magnetos from every point of view—reliability, accuracy and price.

It is, therefore, sincerely to be trusted that in making their plans for the 1915 season, British manufacturers of automobiles—cars, both pleasure and industrial, and motor cycles—will fully inquire into the possibilities of fitting British-made magnetos only, and that manufacturers of the latter, on their part, will do their utmost to demonstrate that either individually, or collectively, they are in a position to supply magnetos of the required standard of reliability at the right price, in the desired quantities, and at the right times. In this connection it is satisfactory to learn that a meeting of motor manufacturers has already been held in Coventry in connection with the supply of magnetos for motor-cars and cycles. A representative Committee was appointed to communicate with English electrical firms, with the view of obtaining supplies of magnetos in the future, and all firms desirous of entering into these important branches of the motor trade are requested to apply to the convener of the meeting, Mr. Harry Smith, of the Rover Co., Ltd., Coventry.

Already it is announced that the British Thomson-Houston Co. has commenced the manufacture of magnetos at its works in Ford Street, Coventry, and that Messrs. Thomson-Bennett, Ltd., of Arden Works, Birmingham, who have been making magnetos on a small scale for several years, are now in a position to turn out 300 machines per week, which number will quickly be doubled if they receive the support from British car manufacturers which they claim they have a right to expect.

There is, of course, a possibility that must be remembered, and one to which we have previously drawn attention, and that is, of a return to accumulator ignition, which would render the magneto unnecessary. With the very wide adoption of a lighting dynamo as a standard portion of the anatomy of a chassis, and in conjunction with this, the installation of a battery of accumulators, there is no technical reason why the latter cannot be used for ignition as well as for lighting purposes, the place of the magneto being taken by a coil and distributor, for with the introduction of the lighting dynamo the old trouble experienced with ignition accumulators—that of keeping them fully charged—has entirely disappeared. Although the change from magneto to accumulator ignition has already been made in one or two American cars, there is, however, no marked tendency in that direction, certainly in this country, so that this should not deter magneto manufacturers from taking all the necessary steps to cope with the trade that is now within their reach.—C. J. W.

Resistance of Steel Conductor Rails: British Standard Specification.—The attention now being given to the electrification of railways makes this report (No. 68) on the British Standard Method of Specifying the Resistance of Steel Conductor Rails of special interest at the present time. The question was brought officially to the notice of the Engineering Standards Committee in March, 1913. In the introductory remarks an explanation is given of the reasons for selecting the particular method which has been adopted of defining the standard dimensions in terms of length and weight per yard, rather than in terms of length and sectional area. Useful tables of reduction factors for converting the resistance of a rail of known weight, measured at a given temperature, to its value in terms of the standard, are given, and in an appendix will be found reduction formulæ, so that previous values for the resistance of rails in terms of copper may be readily reduced to values in terms of the recommended standard.

WAR ITEMS.

"Who's Who in the War" is a little handbook selling at 1s. (one-half of the proceeds going to the Prince of Wales's National Relief Fund), which should be of very considerable service to those who wish intelligently to follow the course of events. Briefly, the compiler sets forth the population, financial position, military and naval strength, religion, foreign trade and certain other important characteristics, of the different countries involved. A collection of political notes forming a diary of events show how the war began, the diplomatic pourparlers that took place between the great powers prior to the outbreak being amply recorded. Military notes compare matters in the year 1870 with the position to-day; military definitions and information concerning the forces engaged, &c., occupy a number of pages, and there are also naval notes, a couple of maps (one of Europe, and the other of the Franco-German frontier), and a good deal of general information. The booklet is edited by Mr. Geo. L. Polsue and published at Gough House, Fleet Street, E.C.

Mr. Hope-Jones informs us that there are practically no German systems of electric clocks in use in this country, so in that branch of business the electrical profession have nothing to make war upon, but can obtain all supplies at home as heretofore. It would have been a very different state of affairs if the war had been declared some years ago. The "War" against German electric clocks began in 1895. England was an easy winner, and it is now generally admitted that in the electrotechnics of electric time service, British science and practice are far ahead of those on the Continent.

We have received the following message from an important electrical company at Ithaca, N.Y., dated August 8th:—"Americans—with but few exceptions, and these are racial—especially in this locality, and that means universally, for we are much alike in such matters, are with the British Government, applauding the dignified manner in which it endured the offences offered against it, and hoping for and predicting complete success for the arms of the Triple Entente to which it is a party. May we add our own good wishes for British success in this uncalled-for conflict of arms—and that right speedily."

The Ediswan Co. inform us that if they could coin a phrase out of the mottoes they have recently seen, it would be "Don't Worry—Work and keep on at it during the alterations to the map of Europe." The staff of employés in the Royal Ediswan lamp manufacturing section is being added to daily and full time worked, owing to increased orders for all makes of Royal Ediswan lamps. The effect of advertising to the trade through the trade papers, the fact that Royal Ediswan drawn-wire and carbon lamps are made in Great Britain by British labour with British capital, has had a very successful and patriotic effect. The company believe that the *All*-British effort, including British capital, is likely to tell satisfactorily upon their business in the near future in a very marked degree. The company have every confidence in the present general situation and in their ability to meet all demands, now and in future, and no effort will be spared to maintain their usual service to the trade. The Ediswan engineering section is able to speak with equal confidence, not only because of the increased activity caused by Admiralty work, but also by the continuation so far of everyday orders, and, in fact, increased orders for many special lines. The firm are paying the wives of the married men serving in the Army half-pay, and will allow the men to take over their old positions upon return.

Owing to the crisis and the resultant sudden and serious advances which are being made generally in raw materials, the Edison & Swan Company notify the trade that the immediate withdrawal of all existing list prices is liable at any moment. Their position as regards stocks of both raw materials and finished goods is such that they are at the moment, and possibly may be for some time to come, able to fulfil all general requirements. In the interests of their regular customers they have had to refuse many offers of extraordinarily large quantities of accessories, which are now in demand owing to the closing down of the German and other Continental markets, and will continue to do so. Though no drastic alterations will be made in prices at the moment, such procedure may become an absolute necessity at any time. They hold large stocks of finished lamps and adequate stocks of raw materials to cope without the slightest hitch with the large increase in the demand for all-British lamps.

Owing to the war the Annual Conference of the Municipal Tramways Association (Inc.), intended to take place at Salford, is not to be held this year. Mr. Holford, the manager of the Corporation tramways, is approaching the management of the various hotels in order to see what can be done respecting rooms already booked. Due notice will be given of the annual general meeting.

The Southend-on-Sea T.C. has received from the British Niclausse Boiler Co., Ltd., a request for the release of part of the retention money (£722 10s., payable on February 11th, 1915), in respect of the boilers, &c., supplied to the electricity works, owing to the company being unable to obtain remittances from France. Subject to the deduction of discount at the current bank rate, it has been decided to pay the company £250.

In response to its circular, the Council of the Institution of Electrical Engineers have received offers of service from some 1,100 members and others. The following is a copy of a circular letter which was posted on August 21st to the engineers of all the electricity supply undertakings in the United Kingdom:—

"National Service.

"Dear Sir,—I am desired to inform you that as the result of a circular sent by the Council to the members of the Institution, the Council have now the names of a large number of electrical engineers who offer their services (subject to various periods of notice) to fill vacancies in connection with the public services, electric power stations, tramways, railways, &c. These names have been classified by means of index cards under various headings, and are at the disposal of your undertaking should any of the men's services be required."

"I am, dear Sir, yours faithfully,

"P. F. Rowell, *Secretary.*

"*August 19th*, 1914."

Reports from Leading Neutral Markets.—In connection with the Board of Trade scheme for assisting British manufacturers and traders to take advantage of the opportunity afforded by the war for securing trade formerly in the hands of German and Austrian or Hungarian rivals, cables were dispatched on August 14th to H.M. Trade Commissioners in Canada, South Africa, Australia and New Zealand, and to British Consular officers in South America, China, Japan and Egypt, asking them to report on the financial and commercial conditions in their districts, and as to the likelihood of regular payments being forthcoming for goods supplied. The following is a summary of the replies which have been received to date:—

South Africa.—H.M. Trade Commissioner reports (August 17th) the existence of depression due to drought which was accentuated by the war. The action of H.M. Government regarding insurance against war risks is highly appreciated. The banks are fully prepared to finance reputable merchants as hitherto, and merchants are ready to carry on trade. Indents supplied previously by Germany and Austria will be executed by the United Kingdom and France.

Canada.—H.M. Trade Commissioner reports (August 16th) that according to the information which he has been able to obtain, the present financial position of importers is generally satisfactory. The approximate value of import trade from Germany is £3,000,000. The following is a list of certain goods in which, in his opinion, British firms might extend their trade as the result of existing conditions:—

Brass articles.	Electric apparatus.
Brass tubing.	Enamelled ware.
Boiler tubes.	Glass ware.
Optical instruments.	Lamps.
Carbons.	Rubber.
Copper tubing.	Zinc bars.

Australia.—H.M. Trade Commissioner in Australia reports (August 17th) that the financial position in that market is strong. The Federal Government is prepared to support the banks if necessary, and the execution of Federal, public and State works will be continued. The commercial position appears to be sound, as the banks are adequately supporting merchants. He considers that there is a good opportunity for manufacturers to secure valuable trade. Firms should cable to their agents that they are able to fill orders if they are in a position to give this assurance.

New Zealand.—H.M. Trade Commissioner reports (August 19th) that the present conditions of trade are disturbed, but he anticipates that this is only temporary, and considers prospects to be good, and regular payments likely to be maintained. An increasing demand for British goods may be expected, but prompt overtures should be made so as to anticipate competition from America.

Brazil.—H.M. Consul-General at Rio de Janeiro reports (August 18th) that an opportunity certainly offers for British firms to secure trade now in German hands. Traders should make arrangements for payment in gold, and not in paper currency, since the Government propose to make a large local issue of paper, and in all probability exchange will decline sharply. British firms desiring to transact business should send competent representatives possessing the necessary technical knowledge to study local conditions. H.M. Consul adds that in Rio de Janeiro firms are in a good financial position, and it should not be difficult to secure regular payment, but the utmost caution should be exercised in the choice of customers.

Argentina.—The British Consul-General at Buenos Ayres reports (August 14th) that the preponderating share of the trade is already in the hands of British firms. Banks refuse to give credit, and there is no money to be had. Regularity of payments cannot be relied upon. There is a danger of depreciation in the value of currency.

China.—The British Consul-General at Shanghai reports (August 15th) that Shanghai merchants are fully alive to the situation. The difficulty in getting shipments away is reacting on the import trade, but Chinese merchants are confident that business will shortly be resumed on a small scale. Silk spinning mills, cotton mills and industrial undertakings generally are working.

The Thermal Syndicate, Ltd., ask us to inform the trade, in view of the dislocation of business, owing to the war, and the lack of supplies of glass and porcelain from Germany and Austria, that they are in a position to supply their vitreosil material promptly, as it is entirely made in their works at Neptune Bank, Wallsend-on-Tyne.

Messrs. Leopold Farmer & Sons, of Gresham Street, E.C., inform us that active steps are being taken by English manufacturers to equip themselves to secure increased trade owing to the present position of affairs. Firms in all branches of trade are seeking factories to open up industries in which they have been barred from manufacture through the low prices of foreign competition. Messrs. Farmer have received applications for factories for the manufacture of goods in the electrical and general engineering trades, soft goods, hardware, chemical and allied industries, from well-known firms and syndicates proposing to establish works for both the export and home trades. "The passing of the Patent and

Designs Act, 1907, resulted in a figure approaching £2,000,000 being expended in land, buildings, plant and machinery, &c., but we can safely say the foregoing results will be eclipsed on the cessation of hostilities by an enormous trade boom setting in for English manufacturers both in old and new markets and a further increase of prosperity to the old country."

From the inception of the drawn-wire process all the wire used in Mazda lamps has been manufactured in Rugby. The wisdom of the British Thomson-Houston Co., Ltd., in this course is more than ever evident in the present crisis—they are, as they have always been, absolutely independent of any other country for the supply of tungsten wire. This fact places them in a certain and safe position, and also assures the advantage to the trade and public of a continuity of supply. The introduction of half-watt lamps was first announced in Great Britain, at Mazda House, on August 26th last year, and ever since that time the British Thomson-Houston Co. have been busily engaged on the manufacture of such lamps, and British-made half-watt lamps are being produced in commercial quantities at Rugby.

Messrs. J. H. Tucker & Co., of Birmingham, have for 20 years been manufacturing nothing but "All British Goods," so that they are, so far, unaffected by the war, and they are "Carrying On" as usual. They have one of the largest works in this country devoted to goods such as they manufacture, and though their name is so well known as makers of "Tumbler Switches," they also manufacture a most comprehensive range of light and power accessories —lampholders, ceiling roses, wall plugs, and similar articles are turned out by their works in very large quantities. They further make a complete range of switchgear—switch and fuseboards, ironclad fuses and switches, distributing boards, house service fuses and similar goods. Their manufacturing policy has been to make themselves "self-contained," and, with the exception of certain raw material, they are practically independent of outside sources of supply.

The Tudor Accumulator Co., Ltd., of Dukinfield Hall, have decided to keep situations open for any of their employés who are called up for service, and, during their absence, to grant half-pay to their dependants.

The Ilford Urban Council has decided to make up the wages of the men who have joined the colours to the amount received while at work. From the electricity and lighting department six men (five of them married), and from the tramway department ten men (four married), have gone.

Another valuable return issued by the Board of Trade Commercial Intelligence Department in connection with the present campaign in the neutral markets, relates to internal combustion and explosion motors, gas turbines, &c. Values are given of exports of these classes from Germany and Austria-Hungary to all destinations. From Germany in 1912 they aggregated £2,826,000, and from Austria £37,000 in 1913. A table shows at a glance the different countries to which these were sent, and information follows respecting the openings that exist in Canada, South Africa, India, Hong Kong, Egypt, Russia, Roumania, Greece, Turkey, Siberia, U.S.A., Japan, and other countries for such manufactures.

Inquiries have been received in the Commercial Intelligence Branch of the Board of Trade from a large number of firms in all parts of the United Kingdom for the names of manufacturers or purchasers of various classes of goods which have been previously obtained from or sold to Germany and Austria-Hungary. Among the articles respecting which inquiries have been received from would-be purchasers are the following :—

Numbering, dating and perforating machines; heat-resisting glasses and globes; glass wool; compressed asbestos fibre jointing; aluminium powder.

Inquiries have been received from manufacturers for purchasers of the following articles :—

Electrical fittings, &c.; electrical hair-dyes; electrical massage vibrators; glazed pressspahn.

Persons interested in any of the above-mentioned articles are invited to write to the director of the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, London, E.C., with a view to being placed in communication with the inquirers.

The *Daily Express* reports an interview with Mr. Hugo Hirst, chairman and managing director of the General Electric Co., Ltd. Mr. Hirst urged that British manufacturers of every kind, after they fulfilled their duty in supporting the British Army and Navy, should strain every nerve to take Germany's place in the British home markets. "Provided we are willing to work as hard as the Germans did, and to sink capital and secure financial and public support, I think there is little doubt that we can replace a large proportion of German imports here at home. This should be our first concentrated care. Our success at home should afford us an excellent springboard from which to leap into Germany's other markets, and the war has already shown that the world's sympathy is with Great Britain, and not with Germany. 'Russia alone,' added Mr. Hirst, 'should offer us a splendid new foreign field for enterprise for a long time after the war.'"

The directors of the Newcastle Electric Supply Co., Ltd., and the County of Durham Electrical Power Distribution Co., Ltd., in response to applications for subscriptions to the various local and other funds which have been opened in connection with the war have decided to make a first subscription of £300, which will be handed over as soon as they are advised as to how such funds will be administered in the service of the areas in which the companies operate.

An evening newspaper states that Sir Adam Beck, chairman of the Ontario Hydro-Electric Commission, has presented his stable of hunters, which remained in England after the Horse Show, to the War Office. The animals are 11 in number, and are worth fully £500 each.

The Schniewindt Electric Co., of Birmingham, has been taken over by the Cressall Electric Co., and we are asked to state that there are no German interests whatever in the new company. The Cressall Co. are carrying on business as usual, and are in a position to execute all orders for resistance nets, &c., promptly. No advances in prices have yet been made, nor will they be unless rise in raw material prices compels.

Mr. William H. Taylor, patents specialist, of 3, Brown Street, Market Street, Manchester, learns from his Paris agent that by a decree given on the 16th inst. the French Government, with commendable thoughtfulness for inventors, will allow applications for patents to be made without payment of the usual application fee of 100 fr. Such payment is only to be made after the war and on a date to be subsequently fixed. The decree applies to British applicants and presumably to all others except subjects of those countries at war with France.

The Board of Trade has made rules under the Patents, Designs and Trade Marks (Temporary Rules) Act, 1914, regulating the procedure for the avoidance or suspension of any patent or licence granted to, or trade mark, the proprietor of which is a subject of any State at war with his Majesty. Where an application is made to the Board for this purpose it must be satisfied that the applicant intends to manufacture the article concerned or carry on the patented process, and also that it is in the public interest that this should be done. The rules provide also for the avoidance or suspension of any application for a patent or trade mark by the subject of an enemy State.

Copies of these rules may be obtained from the Superintendent of the Sale Branch, Patent Office, 25, Southampton Buildings, W.C.

A correspondent writing to the *Times* on the patents question, says :—

"What about those of us who hold patents in Germany? If we appropriate German patents here in Britain, we must expect similar treatment later with our patents in Germany, the granting of which is not only costly, but very difficult to obtain. Would it not be better for the Government to take over the German patents in this country *en bloc* and distribute them out to responsible British manufacturers in this country holding German patents?"

The Edison & Swan Co., Ltd., are supplying to H.M.B.C. *Tiger* a quantity of Admiralty pattern quartzalite radiators. The order has been placed through their Glasgow branch, as the ship is being built by Messrs. John Brown & Co.'s yard, at Clydebank.

Messrs. F. Wiggins & Sons, of 102, 103 and 104, Minories (City), London, ask us to draw the attention of the electrical trade to the following facts :—

"1. We have the largest stock of mica in the world here in our own warehouses in London.

"2. Our prices have not advanced owing to the war except for a few sizes for which there has been a heavy demand.

"3. Shipments of mica to this country are practically all stopped at present, mainly for financial reasons. This will probably continue for some time; nevertheless we believe our stock to be large enough to keep the British electrical industry supplied with mica until further supplies come in, without prices rising appreciably.

"4. We are an all-British firm. Our partners, managers and workpeople are all British, and since we were established in 1840 we have never had anyone but Britishers by birth connected in any way with our firm.

"5. Our business motto is 'A Square Deal.'"

The Government has issued the following explanation of its proclamation against trading with the enemy :—

1. For the purpose of deciding what transactions with foreign traders are permitted, the important thing is to consider where the foreign trader resides and carries on business, and not the nationality of the foreign trader.

2. Consequently, there is, as a rule, no objection to British firms trading with German or Austrian firms established in neutral or British territory. What is prohibited is trade with any firms established in hostile territory.

3. If a firm with headquarters in hostile territory has a branch in neutral or British territory, trade with the branch is (apart from prohibitions in special cases) permissible, as long as the trade is *bona fide* with the branch, and no transaction with the head office is involved.

4. Commercial contracts entered into before war broke out with firms established in hostile territory cannot be performed during the war, and payments under them ought not to be made to such firms during the war. Where, however, nothing remains to be done save to pay for goods already delivered or for services already rendered, there is no objection to making the payment. Whether contracts entered into before war are suspended or terminated is a question of law, which may depend on circumstances, and in cases of doubt British firms must consult their own legal advisers.

This explanation is issued in order to promote confidence and certainty in British commercial transactions, but it must be understood that, in case of need, the Government will still be free to impose stricter regulations or special prohibitions in the national interest.

A Newcastle-on-Tyne paper (*North Mail*) says :—"The manufacture of electrical gear of all descriptions is a rapidly growing North-country industry, and according to a Tyneside authority, Northern firms should do well at the expense of Germany, which had competed vigorously and determinedly in all parts of the world. During recent years she has made a tremendous bid for the electrical trade in this country and abroad. Manufacturers, merely to obtain a footing, readily sacrificed profits—even sold at a loss, and employed all kinds of "dodges" to oust the Britisher. Naturally, this country was bound to suffer, but the blades of war have sliced Germany's trade strings."

Reuter's correspondent in Paris says:—"A number of French firms are anxious to know whether British manufacturers of tools, machine parts, and ironware can supply the goods which can replace similar articles exported from Germany to France. The inquiry seems to have special interest for Sheffield, Birmingham, and Coventry. The British Chamber of Commerce is prepared to assist British manufacturers in getting into touch with French firms."

The views of "a prominent City man who has made a special study of our trade relations throughout the world," have been given in an interview to the Press Association. He said that the idea of seeking information through British Consuls and trade commissioners as to the business done between the Colonies and neutral countries and Germany and Austria and of exhibiting samples for the inspection of manufacturers and traders in the United Kingdom was an eminently practicable one. He expressed the opinion, however, that any accession of trade could only come very gradually. When the war broke out British manufacturers generally were very full up with orders, and any extension of business would probably necessitate the installation of special machinery for the production of certain goods. "Of course," he added, "there is a limited value to what the Consuls and trade representatives may report. The people who really know the position of things are the firms who have been unsuccessful in competing with the Germans and Austrians. They know why they have been unsuccessful, and what is actually required, and they are hardly likely to publish this information to the entire world. Much of the trade which Germany has hitherto been doing she is welcome to retain, because it has been done with countries and firms either bankrupt or on the verge of bankruptcy."

A Manchester correspondent, writing on "Lancashire and the War" in the *Financial Times*, states that vigorous efforts are being made by British manufacturers in the North, particularly in the electrical and chemical industries, and many sections of the cotton trade. "The British Westinghouse Electrical and Manufacturing Co. has, since the outbreak of the war, received important orders from Norway and elsewhere which, it is affirmed, would otherwise have gone to Germany. Similar reports come from other important electrical, general engineering and textile machinery concerns in the Greater Manchester district, some of which are now preparing to open out new departments. Most engineering works would already be very busy but for financial questions—mainly the existence of the moratorium, and the absence of normal facilities for bill discounting."

"A Rejected One" writes:—"It is time that everyone recognised the facts as to the German menace of the last quarter of a century more particularly, or say, rather the last 30 years. It has been not merely a military and naval menace, but an industrial and an immoral menace. I have had special means for knowing something of the internal arrangements of the means by which Germany has fostered her trade in this country, and it is for these reasons that I have become so bitter an opponent of municipal trading and of municipal picnics upon the Continent in general, and to Germany in particular. My observations convinced me that the electrical orders which went to Germany, went there as a result of improper methods. When I have read of the impossibility of obtaining what was wanted at home, and that it was compulsory to go to Germany, I have felt convinced of the real reasons. With Germany already pressing on the French defence, is it not time that the 500,000 men wanted by Kitchener should be forthcoming? Instead, they are busy with cricket or 'lolling with a dolly' on the sand."

Mr. D. G. E. Barrie, of Clapham Junction, writes to us as follows:—"The Unpatriotic English Manufacturer. The English manufacturers for years past have complained about the unfair competition set up by German manufacturers, and now their chance has come to collar the trade hitherto held by the Germans, they are, instead of trying to encourage it, simply handicapping it. Instead of standing by their customers in the time of need, they are pressing for payment of accounts and refusing to supply customers on books except for cash; the result is that a lot of firms who could have stood the racket have had to close down, thus throwing a large number of hands out of employment."

As the Swiss Government has mobilised, the Bureau International de l'Union Télégraphique and Convention Radiotélégraphique Internationale notify their inability to cope with the work to be performed as so many of their employés are serving with the army. It has been consequently necessary to cease the publication of the *Journal Télégraphique*, and the preparation of the nomenclature of radiotelegraph stations, as well as the preparation of the map showing such stations and shipping routes. Delay in dealing with communications from Administrations will also necessarily result.

A further statement issued by the Board of Trade deals in full detail with German and Austro-Hungarian exports of industrial and agricultural implements and tools, and also the exports of similar manufactures from the United Kingdom. Notes are given from which an idea may be obtained regarding the prospects for doing additional British business in various specified markets. This return, like the others of the series, will doubtless be called for by many of our manufacturers.

A Historic American Vehicle.—A three-wheeled electric car "of the vintage of 1893" has recently been presented to the American Electric Vehicle Association of New York, and will be preserved as a relic. Its builder is now unknown, and there is little but its antiquity to recommend the quaint little vehicle

LEGAL.

An Electrical Contract.

The *New Zealand Times* contains an account of a case adjudicated upon by his Honour the Chief Justice (Sir Robert Stout) in the Supreme Court, Wellington, in which Messrs. Turnbull & Jones, Ltd., proceeded against the Taihape Borough Council, seeking a declaration of the Court that the defendant Corporation was bound, by the orders of its engineer, to alter works under a contract entered into between the defendant and the plaintiff.

The contract was for the construction of a hydro-electric lighting plant, and in the general conditions there was the following clause:—

"If any alteration shall hereinafter be made by order of the Borough Council by varying the plans or specifications, or otherwise, such alterations shall not vitiate the contract in anywise, but any alteration in the works ordered by the engineer in writing shall be executed by the contractor, and the value thereof, whether additions to or deductions from the works included in the contract, shall be ascertained by the engineer, without reference to any person whatever, and the amount thereof shall be added to, or deducted from, the amount of the contract, as the case may be."

After the contract had been entered into, the plaintiffs' engineer visited the proposed site of the works, and found that alterations would have to be made in the mode of constructing the works. Most of the suggested alterations were approved by the Council's engineer, who wrote ordering Messrs. Turnbull & Jones to make them, including a change of turbine from double to single discharge. The Council, however, objected to the alteration of the specified turbine. Before the plaintiffs received notice of the objection they had ordered the single discharge turbine from England. It was agreed between the parties that if the plaintiffs had to pay any damages for cancelling the order, the defendants would leave it to an arbitrator to state what sum the defendants should pay, provided that the Court determined whether the engineer had power to change the double discharge turbine to a single discharge turbine.

According to the report before us, his Honour remarked that this was not a case in which the engineer had by an order increased the cost of the works. On the contrary, the cost would have been lessened by some £500 if the engineer's alterations had been carried out. The class of cases, therefore, in which the engineer or architect had purported to increase the price or cost of works did not apply. After considering the legal aspects of this and relevant cases, his Honour said he was of opinion that the plaintiff was entitled to the direction asked for, and that the engineer had power to change the one turbine for the other.

Judgment was given accordingly. Costs would be on the scale to be fixed by the quantum of damage awarded, and might be reserved until this was settled, or until the further order of the Court.

Charge against an Electrician.

According to the Birmingham *Daily Post*, George Kertland, a young electrician, belonging to Shepherd's Bush, was charged at Wimbledon on 19th inst. with being concerned with two other men in breaking into the Foster Engineering Co.'s works at Wimbledon on the previous Sunday night and stealing carbons and other material valued at about £2,000. It was stated that he arranged with a London firm of carriers to remove the goods in motor-cars from the works shortly after midnight on Sunday. Five hours were taken by him and two other men in packing them. They weighed about 13 tons, and were removed to a place at Hayes, Middlesex, where the police found most of them. The rest were stopped in transit on the Great Western Railway.

A detective-sergeant said that when he arrested the accused Kertland stated: "I have a complete answer to the charge. These carbons are the property of an alien enemy, and the Government want carbons, and we have the authority of the Treasury."

He was remanded in custody.

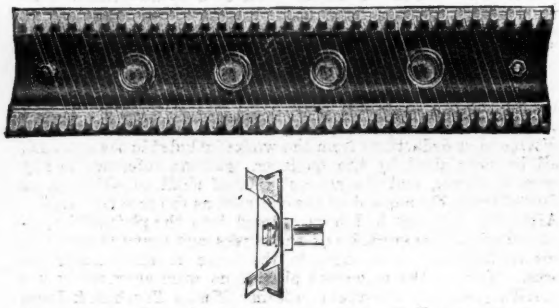
U.S. Army Wireless Outfit.—A portable wireless outfit, which can be set up in 12 minutes and has a radius of operation up to 800 miles, has recently been adopted by the U.S. Army Signal Corps. It includes a motor-wagon, with a 30-H.P. engine, which is geared to a 110-volt generator, current being stepped up to 22,000 volts pressure for the wireless equipment. The antennæ are of the umbrella type, attached to an 85-ft. mast, which is built up in nine sections by block and tackle, and is transported in compartments of the truck. The counterpoise or artificial ground consists of heavy insulated wires radiating from a common centre, to which is attached the ground wire of the set.—*Elec. World.*

Faraday House Electrical Engineering College.—In view of the large withdrawal of engineering students from Continental colleges and works on account of the war, the Governors of Faraday House are willing to offer special arrangements to those who wish to join the College. They are prepared to take into consideration, as far as possible, the time already spent abroad, and to shorten proportionately the four years' course ordinarily required for the diploma. Students would complete their practical training in large engineering works and power stations in the United Kingdom.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Credenda Electric Fires.

The Credenda Conduits Co., Ltd., of Chester Street, Aston, have brought out a range of electric fires, for which Messrs. Baxter & Caunter, Ltd., are the London agents. The fires are fitted with a new bar unit which is being patented, consisting of a metal frame carrying eight dove-tail sections of steatite; the latter have



Figs. 1 and 2.—Credenda Heating Element.

a number of projections on which is wound the nickel-chrome heating wire in zig-zag. Holes in the metal channel allow air to circulate through the hot-wire grid, cooling the metal frame and preventing overheating of the wire, which works in free air. As the sections of steatite are of small dimensions, breakages are minimised. Each bar unit has a plug contact at each end, so that bars for different voltages can easily be inserted, and the whole

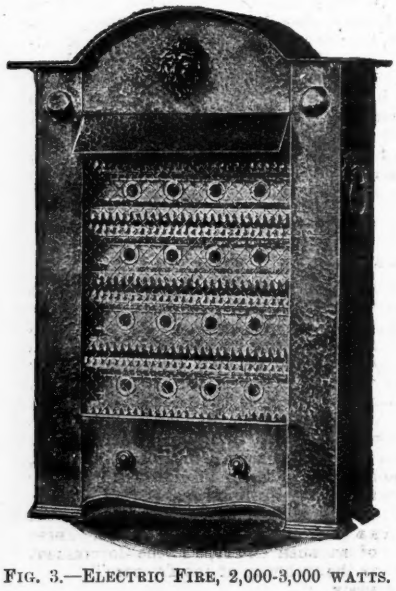


Fig. 3.—Electric Fire, 2,000-3,000 watts.

frame which carries the bars can readily be removed with the switches and wiring from the outer case, after taking off the bottom and unscrewing the switch rings. The bars are interchangeable, and as they are coupled in parallel, the removal of one does not affect the others. Owing to the width of the elements, less bars are required to make up a given area of heating surface, and longer lengths of heavier gauge wire can be used without spiral winding, which has a tendency to local heating.

Figs. 1 and 2 show one of the bar units, and fig. 3 one of the many patterns of fire in which the bars are used.

Heating and cooking apparatus are also made by the company.

The "Jumper" Control Gear.

The starting and stopping of hydraulic pumps automatically is usually done by the accumulator actuating a trip switch or pilot valve by tappet gear, and in the case of air compressors, by the variation in pressure in the receiver.

From a mechanical point of view, this should be done gradually, and from an electrical point of view, with as little sparking and excess of current as possible.

As electric motors, particularly of the A.C. type, start up and stop much too quickly for ideal pumping conditions, the pumps should preferably be unloaded prior to these operations, in which case there is less current to deal with; furthermore, the motion imparted to the controller should be slow when on the contacts and relatively quick when passing from contact to contact.

The "Jumper" control gear, which is here described, is made by the Leeds Engineering and Hydraulic Co., Ltd., Rodley, near Leeds.

Fig. 6 shows a section of the gear proper, which consists of a hydraulic cylinder A actuated by a pilot valve B and accumulator striking gear C, C (shown on fig. 5), a cataract D, a sentinel valve E for actuating the unloading valve F (shown on fig. 5), the speed of the unloading valve being governed by the needle valve G, a

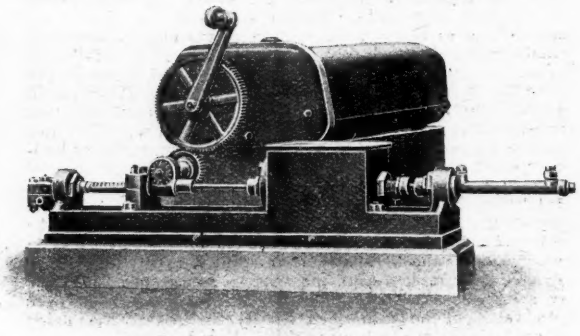


Fig. 4.—Controller with "Jumper" Gear.

rack and pinion and gearing or pitch chain being employed for connecting the gear to the electric controller H.

When the gear is in full "on" position, and not until then, it actuates the sentinel valve, which closes and keeps closed the by-pass valve which loads the pump; in like manner, when the accumulator has reached its highest position and tipped over the pilot valve, the main gear moves it to the "off" position; in

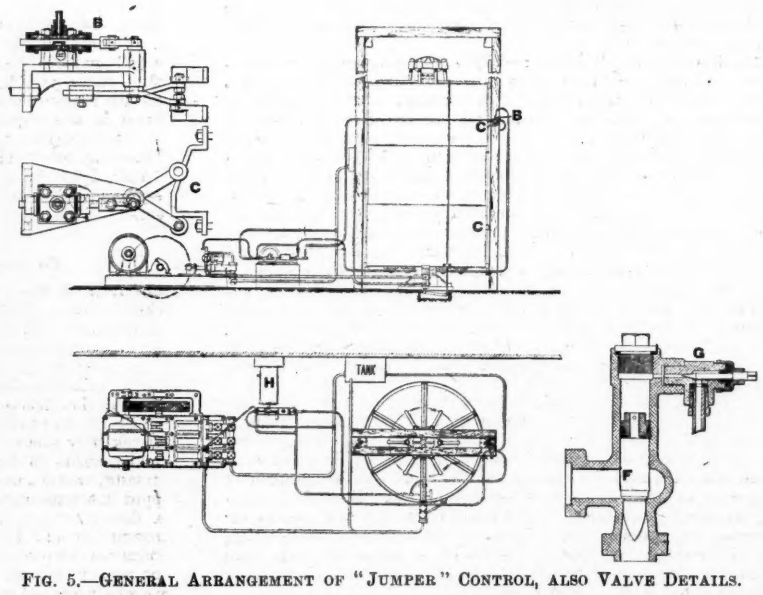


Fig. 5.—General Arrangement of "Jumper" Control, also Valve Details.

doing this, it first unloads the pump by opening the by-pass valve.

The "Jumper" gear can be made to actuate any type of electric controller, but the controller generally preferred is the tramway type, because the contacts are usually large, easily get-at-able and cheaply renewed.

In order to reduce the wear and tear of the contacts, it is desirable to impart a "jumping action" to the controller drum—hence the name. This is effected by inserting a rod M inside the cataract D on which there are a series of alternately raised and recessed parts corresponding with the number of contacts in the controller. The raised parts fit the hole in the cataract piston N.

When the piston comes to a raised part, it passes slowly over it, and when it comes to the recess it jumps forward, and so on. The time taken to pass over each raised part may be varied in either direction by the needle valves, K, K, while the cataract cylinder is kept solid by suction valves L, L.

The cataract cylinder is submerged in the fluid, which is entirely enclosed in order that it may keep clean and require renewing infrequently.

During such periods the pump can be automatically loaded and unloaded by opening and closing valves which connect the accumulator pilot valve with the by-pass valve and disconnect the gear, in which case the pump is started up unloaded, by hand, by

withdrawing the catch pin in the controller handle, which engages with the stop of the gear wheel. It will be noted that the by-pass valve F is made acorn shaped so that it shall open and close gradually; a non-return valve must be placed between the by-pass valve and accumulator.

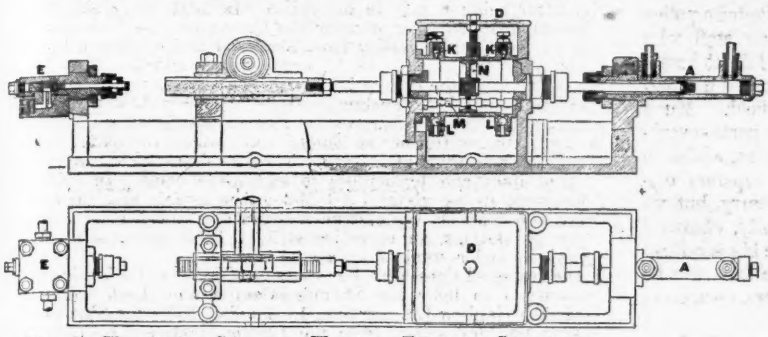


FIG. 6.—HYDRAULIC GEAR FOR WORKING ELECTRIC CONTROLLER.

Electric Fittings.

MESSRS. J. & W. B. SMITH, of 15-23, Farringdon Road, London, E.C., who have had a lengthy experience in the manufacture of fittings and accessories for lighting purposes, are engaged upon a large development of their electrical business. They have just issued for the coming season an excellent catalogue of 140 pages, in which these are set out in detail; and at their showrooms, as we have seen for ourselves during the last few days, they have on exhibition a representative collection of practically all the lines included in this publication, as well as a number of novelties to which we hope to make reference in due course. The manufactures fitting with 14 in. diameter band, and "Pearlite" dish. Other manufactures in the catalogue include Holophane bowl reflector fittings and glassware, church fittings, "Glasmi" luminous electric

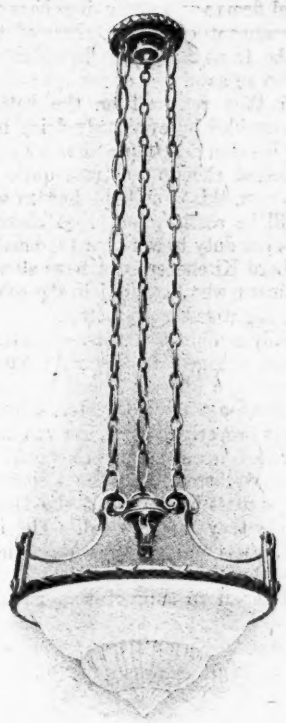


FIG. 8.—GEORGIAN SEMI-DIRECT FITTING.

radiators, "Holborn" electric fires, electric heating and cooking apparatus, and a variety of tumbler and other switches, bells, "Glasmi" conduits and fittings, illuminated signs, electric fans, weatherproof outside lanterns, and so forth.

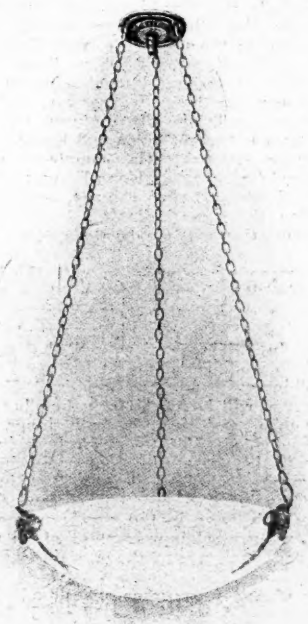


FIG. 7.—CHAIN-SUSPENSION SEMI-DIRECT FITTING.

are practically British-made throughout; it is only in the case of one or two exceptions, such as certain special lines of glassware which have hitherto been peculiar to the Continent, that this is not the case. Large stocks are held in readiness for immediate delivery—a point of even more than usual importance in view of the present crisis, which is making increased demands on firms dealing in lighting supplies. Contractors and trade purchasers are invited to make full use of the showrooms for their own and their clients' edification and instruction. We noted on the occasion of our visit the very clear marking of fittings with catalogue prices. The catalogue starts off with a variety of lamp-shades in plain and fancy glass, beads, silk and cardboard. Some attractive examples of china portable table standards, statuettes, brackets, pendants, hall and other lanterns, ceiling lights, adjustable pendants, candle fittings, and a full collection of electroliers, follow. Semi-direct lighting fittings form a special feature, quite a number of different and pleasing designs being shown fitted with "Pearlite," pearl onyx and "Radiac" dishes. We select a couple of these examples for illustration, fig 7 showing a chain-suspension polished-brass fitting, with pearl onyx dishes of 12 and 14 inches diameter; and fig. 8 representing a Georgian antique brass-finished

Totally-Enclosed Circuit-Breakers.

In industrial work it is desirable that circuit-breakers and other electrical gear shall, wherever possible, be totally enclosed. THE GENERAL ELECTRIC CO., LTD., of Witton, Birmingham, have recently introduced a new design which is shown in the accompanying illustrations. The circuit-breaker is fixed in a strong cast-iron case intended for mounting on a wall or angle-iron framework. The lid is hinged and is interlocked with the switch by means of the G.E.C. patent interlock. The important feature about this circuit-breaker is the fact that the breaker can be opened and closed with the same handle—a great improvement over the usual method of operating, as no special lever for tripping is necessary.

FIG. 9.—STANDARD "SALFORD" CIRCUIT-BREAKER IN CAST-IRON CASE.

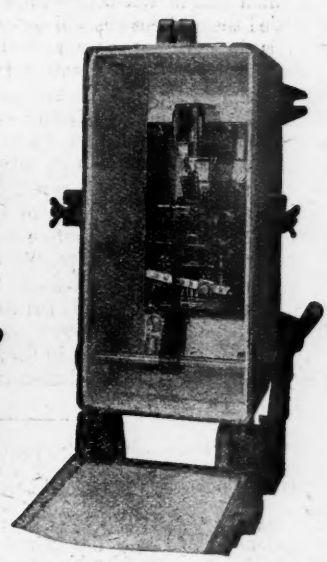


FIG. 10.—INTERIOR OF "SALFORD" CIRCUIT-BREAKER.

THE PRINCE'S RELIEF FUND.

Many electrical firms and undertakings have adopted a policy of generous treatment of the members of their staff who have gone to the front and their dependants left at home, giving them also an assurance of an open door and a proud welcome when they return from the battlefield. Much distress will be avoided by everybody doing his part—everybody sweeping his own doorstep. For some firms, added to the already present though we trust quite temporary dislocation of business, this is no light burden to carry, but we are sure it will be carried, and that cheerfully, wherever possible. It is our duty to work hard and make big sacrifices in order that Lord Kitchener may have all the men that he asks for. To many who long to join the colours, assurances of such a kind might settle the matter.

We are equally confident that manufacturers, professional men, and others engaged in electrical pursuits will contribute liberally to the Prince of Wales's Relief Fund. The response has been magnificent thus far, showing that where national spirit is properly aroused, the well-springs of charity may still be relied upon. The needs will be such as we have never known before, and the resources available to meet those needs must be worthy of the nation and Empire in whose defence they are incurred. The interests of the Fund have, doubtless, already come under the notice of most of our readers, but we may be allowed to add our own earnest appeal to all to support this noble and beneficent effort on the part of the Prince, and subscribe as heavily as their other claims will permit them to do. A coupon for their convenience is given in our advertisement pages.

TELEGRAPHS AND TELEPHONES IN CHINA.

Below we print extracts from an extremely interesting and exhaustive report on proposed telegraph and telephone construction work in China, by Mr. George E. Anderson, the American Consul at Hong Kong. A good deal of the extensive work proposed has been held up owing to the political condition of the country, but the writer of the report is of the opinion that in due course when the position becomes more settled these extensions will be carried out in their entirety. It is interesting to note that the official programme was drawn up with the intention that the materials for the work should be manufactured as much as possible in China, but it is extremely doubtful whether this intention will be realised to anything like its full extent. We are afraid that our firms, not only electrical, have been rather slow to realise the immense opportunities which will arise for construction work in China when political affairs are settled, and it is therefore gratifying that the Board of Trade should have so speedily carried out its intention of sending a special Commissioner to China to study the conditions and prospects of British trade in that important market. The Commissioner, Mr. T. M. Ainscough, is now prosecuting his enquiries in China, and we shall look with confidence for some valuable information and suggestions when he returns.

There is some uncertainty as to the immediate future of telephonic and telegraphic development in China, especially concerning telephones in and between cities, which is a matter of finance. Reporting on this subject recently the American Consul at Hong Kong points out that the country's telegraph system is owned by the Chinese Government and has been operated with considerable success for several years both in domestic and foreign services. Immediately after the revolution an expansion policy was determined upon by the Government telegraph administration comprising a supplementary telephone service to be owned and operated by the Government and telephone extensions in various Chinese cities. The telegraph administration borrowed £500,000 from the Eastern Extension and Great Northern Telegraph Co. (the cable company with which it is most intimately connected in foreign business) to extend its telegraph lines and to establish certain telephone lines. Interest and payments were to be met out of current earnings of the administration on its foreign business.

The telegraph extension was in keeping with the steady growth of the system. The first lines in China were between Shanghai and Tientsin and between Shanghai and Woosung, the latter being a private enterprise. In 1884, the Peking-Tientsin line was taken over by the Government; a line was run up the Yangtze Valley from Shanghai and through communication was established between Canton and the North. Since that time the system has been steadily extended to the Russian frontier at Hunchun, Helampo and Kiakhta; to the Japanese frontier at Wiju; to the Burma frontier at Bhamo; to the Tongking frontier at Mankai and Laokai, and as far as the Tibetan frontier at Batang. There are now 36,339 miles of land lines and 1,000 miles of submarine cable. In 1913 there were in use about 1,300 Morse instruments and something less than 50 Wheatstone instruments; there were 561 telegraph stations, an operating staff of 1,900 natives and 6 foreigners and a total of 7,522 employés.

The principal lines are: The Shanghai-Tientsin, 1,025 miles, constructed in 1882; the Shanghai-Canton line, 1,820 miles, 1882; the Hankow-Luchow line, 1,047 miles, 1886; the Sianfu-Peking line, 964 miles, 1890; the Peking-Kiakhta line, 1,061 miles, 1897; the Shanghai-Hankow line, 873 miles, 1884; the Hankow-Peking line, 974 miles, 1910; and the Kiukiang-Canton line, 988 miles, 1884. The capital expended upon these various lines is about £560,000. The charge for service is about 2d. per word for messages in a foreign language in the same Province; about 4½d. per word for messages to all other places in China, and about 1½d. for Press messages throughout China. For Chinese messages, which are usually transmitted by sending numbers corresponding to words in a sort of telegraphic dictionary or code book, the charges are two-thirds those for foreign messages, the Chinese Press rate being about ¾d. per word. These charges are for all words, including address and signature. The rates, therefore, are high.

While the construction programme provided for in the loan agreement has been interfered with considerably by disorders and disorganization attending the revolution, most of the extensions planned in the elaborate programme outlined by the Government are being made. The extensions made in the past two years include the Hunkiang and Yungchow lines in Hunan Province; the Chowchia-kou and the Hanchow lines in Honan Province; the Anhui Province lines in Anhui; and in Kwangtung, the Kaochow-Pi-ching lines. Extension of the northern and southern telegraph circuits in Shensi and Shansi Provinces has been in progress, and some extensions have been made in Kwangtung and Kwangsi Provinces and in lines between Fukien and Kiangsi Provinces. Recently the Eastern Extension Co. completed a new telegraph line from Kowloon, a part of Hong Kong, to the Chinese frontier along the Kowloon-Canton railway, and the Chinese are now completing the line to Canton. When completed, this will be the third through line between Hong Kong and Canton.

The official programme in connection with the loan agreement provides that in 1914 telegraph lines will be extended from Hsingi in Kweichow to Kwangnan in Yunnan, and from Chengtu, the capital of Szechwan Province, to points in Kansu Province. In 1915 extensions will be made to the lines between Puerh and Hsunning in Yunnan, and to the lines between Chingyuan in Kwangsi and Kueiyang in Kweichow. A survey will be made for a line between Urga and Kobdo, Mongolia, and lines in both inner and outer Tibet will be extended. In 1916 telegraph lines in inner and outer Mongolia will be extended. Plans will be made for constructing telegraph lines from Paotien-Chen in Ninghsia, from Kansa to Chinghai and inner Tibet, and from Ili to Kuche. The telegraph lines in the northern provinces will be reconstructed and general improvement of all the electric lighting plants and telephones in the Empire will be undertaken.

Just how much of this programme will actually be realised is difficult to foresee. Much of that planned for the past three years has been accomplished more on paper than otherwise and there has been complaint that much of the disorganisation and confusion attendant upon the change in Governments has been especially noticeable in the office of the Board of Communications, in which much of the administration of such extension and other work centres. Much has been done, however, and since the work being done and proposed is largely under foreign supervision and control it is likely that, in general, plans for the general improvement of the service will be successfully carried out in course of time.

A great deal of the official programme has had regard for the manufacture of telegraph and telephone, as well as electric light and power, materials in China. Representatives of the Government have been sent abroad to study foreign establishments manufacturing such materials, and in the official programme it has been planned that new depôts for the manufacture of such goods shall be established during the current year, while in 1915 the work is to be extended to include all materials used in wireless telegraphy. However, there are indications that financial considerations will interfere materially with this programme for the present.

The use of the telephone in China is much more limited than the telegraph, though the Chinese take to the telephone with extraordinary readiness. Modern inter-urban communication by telephone is almost unknown in China, the only exceptions being the line between Pekin and Tientsin and several small ones used in connection with the dispatch of

railway trains. Local telephone exchange systems are found only in Peking, Tientsin, Shanghai and Canton. They are Government owned and are operated as a part of the telegraph system. The number of subscribers is not available, but the exchanges are small.

As a part of its policy of extension the Chinese Government is increasing the use of the telephone as an adjunct to the main telegraph system, the telephone being used to forward telegraph messages from the ends of telegraph lines to interior points not yet reached. In the past two years considerable extensions have been made to the systems in Chekiang and Kiangsu Provinces, in extending the local service from Shanghai and in Cupel, Yunnan, Shensi, Hunan and Shantung Provinces. The programme for the current year provides for extensions of the systems in Szechuan, Yunnan, Kweichow, and Kwangsi Provinces and in the next two years it is planned to extend these small telephone systems into Kweichow, Yunnan, Szechuan and Kansu Provinces and to include Tibet and the New Dominion if possible. Much of this programme, however, is at present uncertain in view of the political condition of the country and of the political considerations some of the proposed extensions will involve. Considerable actual improvement has, however, been made in many parts of the country including points near Hong Kong, and there is no doubt that the general work will be undertaken as soon as financial and other considerations make it possible.

The United States has had little or no part in the construction or equipment of either the telegraph or telephone systems of China. The telegraph systems were introduced in the first place largely through the efforts of Danish interests, and nearly all of the extension work has been done by Danes, Swedes, Russians, or other North-European people. Naturally North-European instruments and materials have been preferred. In the way of telephone equipment, American instruments and materials are generally too high in price for the service demanded. American expert service is too high-priced to be used in such work, as a usual thing, and this has operated to advance the interests of manufacturers of other nations. So far as local exchanges are concerned, the question of finance has entered in a controlling way and foreign instruments have been introduced in the new Canton exchange, for example, because the foreign concern selling them was in a position to finance the enterprise. A considerable proportion of Chinese equipment is being used, the product of Government concerns in North China.

It is uncertain exactly what course development of telephone systems in the cities of China will take—that is, whether they will come by private initiative and investment or solely through Government operation and control. At present, the Government seems disposed to control such services directly and to own and operate them so far as may be possible. While the Chinese take to the telephone readily and gladly, it is difficult to obtain enough subscribers in a Chinese city to support a system, and it is a long struggle to make a system pay financially without Government support or without connection with some other enterprise like the telegraph system. Nevertheless, the extension of the use of telephones in all parts of China will doubtless be great, and in some cases rapid, as soon as more settled conditions obtain.

The plans of the Chinese Government also include establishing a comprehensive system of wireless telegraph stations. Stations of various degrees of power have already been established at various points in the north, along the coast, and in the south, particularly at Peking, Tientsin, Hankow, Shanghai, Canton, and Hoihow. In Canton the main station has been made the centre of a series of 12 sub-stations in Kwangtung Province, and a school for the instruction of operatives has been established at Canton. In western China various stations have been established under the Board of War. Plans for much more comprehensive and powerful stations along the coast, including Peking, Hankow, Shanghai, Swatow, and Canton, have been made and a contract for their erection has been initiated, but pending the raising of the necessary funds the enterprise is temporarily held in abeyance. The proposed system, however, will have a radius of 1,500 miles and will include stations at Kalgan, near the Siberian border, and on the Pratas Island shoals, about 600 miles south of Hong Kong, where a station is urgently needed for meteorological purposes and the protection of shipping.

BRITISH-MADE CARBONS IN WAR-TIME.

The following communication has reached us too late for inclusion among our "Correspondence." The matter is one of supreme importance at the present moment. The General Electric Co., Ltd., is to be congratulated upon the fact that every need of the Government for carbons for war and other purposes can be met within these islands. We need have no fears in that direction. Our readers will remember the speeches of the late Mr. G. Byng in the early days of the Witton carbon works, in which he laid stress upon the national aspect of the company's carbon-making operations. Mr. H. Hirst likewise has shown an equally commendable foresight in regard to the same matter. Now that the catastrophe of Continental war is in progress, and we are in the main dependent upon what we can do for ourselves, the value of the General Electric Co.'s efforts, conducted at a great loss to themselves, is obvious to everybody. The demands of the Government are imperative, and of course the nation has first call upon us all. Horses, motor-cars and other necessities are commandeered, and we resign ourselves to the inconvenience consequent thereupon. The limited output of carbons will probably likewise entail upon many of us in the electrical world an inconvenience which will be very real, but we shall, so long as the war lasts, have to resign ourselves to that also. In this, as in other matters, we shall find it necessary to accommodate ourselves to the situation. In some directions it may be compulsory to use other means for effecting our electrical illumination. Having watched the position for some years, more or less closely, we would urge upon the trade the wisdom of meeting the difficulty with those infinite resources of which it is possessed. After the Government requirements have been met, the available balance of British-made carbons will be dealt with as fairly and equitably as possible, and though, as we say, there may be inconvenience and hardship, the difficulties will, we are sure, be fully appreciated and understood.

Arc Lamp Carbons.

As it is impossible for us to explain the position in the arc lamp carbon industry individually to all inquirers and users, we should be glad of the hospitality of your columns for this purpose.

Our carbon works is the only factory in Great Britain, and the enormous preponderance, approximately nine-tenths, of the carbons used in this country have been imported from abroad from factories in Germany, Austria and France, which for some time to come cannot send supplies. A very small percentage of the carbons imported came from small Swiss and Spanish works, who can do little if anything to relieve the situation. A factory exists in the United States, but will be called upon to make up for the large American demand hitherto supplied by Germany. In addition, it must be remembered that the British Dominions have been large buyers of German-made carbons.

Under the now prevailing circumstances we have not been surprised during the past three weeks to receive enormous demands for carbons for both immediate and forward delivery. In less than a week we could have sold our output a year ahead. A few of these inquiries came from our old customers. The majority from the large users, such as railway companies and municipalities, who have consistently refused us their support in the past, on account of the cheaper prices of German and Austrian carbons.

Our endeavours to educate users to the necessity of supporting the only English works with only a small portion of their requirements have been constant for 12 years, but without practical results.

When our works were started 12 years ago the prices ruling for carbons were about double those recently prevalent in this country. The starting of our works was met by a persistent policy of price-cutting on the part of our competitors, which at once made the factory unremunerative. In spite of this we have kept our works running, because we recognised the possible disaster if this country had not at least one source of home supply. This policy has involved our company in a loss amounting to over £70,000, which has naturally not encouraged us to increase the factory to a size capable of supplying a reasonable share of the English demand.

We are, therefore, now faced with a demand some 10 times as great as we can satisfy. After serious consideration, we have decided to act upon the following principles :—

1. In the first place, we shall, of course, supply all naval and military demands.

2. We have raised prices, not merely to a remunerative level, but sufficiently to prevent buying by those who are not in absolute need. In this connection we realise that it is possible for many of the largest users to replace temporarily their arc lamps by other forms of lighting such as metal-filament lamps, and those who are in this position should be encouraged to do so.

3. We shall dispose of our present stock of carbons of all kinds according to the above principles, but as far as manufacture is concerned, we shall adhere to the programme described below.

4. We propose to limit our manufacture to as few types and sizes as possible in order to obtain the maximum output from our existing works.

We would point out in this connection that by reducing the number of sizes we make, our output can be very materially increased, as the machinery can be utilised to the best advantage.

In deciding what sizes we shall make we have been principally guided by the consideration of what types of arc lamps can best be replaced by other forms of illuminants, and, so far as possible, we are therefore confining our manufacture principally to those types of arc lamps, which, in our opinion, cannot easily be replaced.

We propose, therefore, in the first place to make carbons for Magazine flame lamps, as there are many thousands of such lamps

in use of two or three well-known makes using the same sizes of carbons. Subject, of course, to possible Government requirements, our output of these Magazine carbons should be sufficient to meet all demands. These carbons are 9 mm., 8 mm. and 7 mm. in diameter in 15-in. and 12-in. lengths. Similar carbons with the addition of 10 mm. diameter—if provided with metal cores—can be used in these lengths in practically all converging carbon flame lamps.

Secondly, we shall manufacture a certain quantitly of 11 mm. and 13 mm. enclosed lamp carbons in 12-in. and 10-in. lengths, as enclosed lamps are used for certain purposes for which other sources of lighting are not suitable.

Thirdly, we propose to make a certain quantity of carbons for projection work for cinematograph and similar purposes, where the quantities are comparatively small, and where also any other source of light is inadmissible. The stoppage of these supplies would paralyse the whole trade, and cause very great distress.

As we realise that the amount of open-type carbons, which we could by any means produce, would be a mere drop in the ocean, we shall discontinue for the time being the manufacture of these entirely.

We are confident that in taking this course we are acting in the best interest of carbon users and the public generally, and hope our policy will meet with general support. Individuals will realise that where it is absolutely impossible to satisfy all, we are taking a course which enables us to satisfy the greatest number in our power.—Yours faithfully,

THE GENERAL ELECTRIC CO., LTD.
K. ALWOOD, *Secretary.*

London, E.C., *August 26th*, 1914.

BUSINESS NOTES.

Book Notices.—"British Standard Method of Specifying Resistance of Steel Conductor Rails." London: Crosby Lockwood & Son. Price 10s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers," Vol. XXXIII, No. 8. August. New York: The Institute. Price $1.

"Calendar of the Royal Technical College, Glasgow, 1914-1915." Glasgow: The College.

Annual Outing.—The first annual outing of the ALPHA MANUFACTURING CO., of Balham, was held on Saturday, 22nd inst., when the men, numbering 28, went to Brighton for the day. Dinner was served at The Pavilion Creameries, Mr. G. F. Beare presiding. Mr. Fletcher, secretary for the outing, on behalf of the men, thanked the firm for keeping the whole of the staff on during the present crisis.

Bankruptcy Proceedings. — GRANVILLE BURGESS, electrical engineer, 27, Museum Chambers, Bury Street, W.C.—A sitting of the London Bankruptcy Court was held on Tuesday before Mr. Registrar Hope, for the public examination of this debtor, who failed in July, with liabilities £463 and assets valued at £88. Replying to Mr. E. Leadham Hough, Senior Official Receiver, the debtor stated that, having previously been employed in the trade, he, in February, 1913, commenced business as above, and carried on the same until the receiving order was made against him on July 7th at the instance of creditors. Witness attributed his insolvency to loss in carrying on business owing mainly to the recent long-continued building strike. This was his first failure. The examination was concluded.

F. T. JOHNSON (F. JOHNSON), electrical engineer, Cambridge. Trustee (Mr. H. N. Cox, 5, Petty Cury, Cambridge) released June 19th.

Catalogues and Lists.—EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD, Ponder's End.—Two wall showcards, one denoting that Ediswan drawn-wire lamps "stand alone," and the other emphasising that Ediswan fans are "All-British." The company announce that owing to the large increase in trade in radiator lamps last season they anticipate an even larger increase during the coming months, and have decreased their prices accordingly. All voltages will drop in price to one standard.

MR. C. H. BLUME, White Building, Sheffield.—Price leaflet relating to "Megomac" and "Insulac" insulating varnishes. These varnishes are manufactured at Mitcham, Surrey, where large stocks are held.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Illustrated leaflet giving brief particulars and prices of watertight switches with turn movement, a new pattern of which, in brass, has been introduced for marine installations, &c.; brass and lead bushes required by engineers who object to tube-end bushes made of wood or moulded insulation material; and chain-pull switch boxes for use in conjunction with Simplex watertight fittings.

MESSRS. BELLING & CO., Edmonton, London, N.E.—Illustrated list giving reduced prices, which came into force last Monday, of Belling's electric boiling rings, grillers, combined griller-ovens and electric fires, all of which, of course, are British made.

MESSRS. CUTTING BROS., LTD., Park Works, Stamford.—Card giving tabulated prices and specification of enclosed ventilated electric motors, ranging from ¼ to 30 H.P.

Trade Announcements.—The Dey Time Registers, Ltd., of Queen Victoria Street, E.C., have amalgamated with the International Time Recording Co., Ltd., of City Road, E.C., and both firms will give up their present premises. The combined businesses will be known as the INTERNATIONAL TIME RECORDING CO., LTD., and will occupy the entire five-storey building, 30/32, Farringdon Road, E.C. Their range of all kinds of time recorders for time-keeping and job-costing is very complete.

MR. J. MARTIN BLAIR, 53, New Broad Street, E.C., has been appointed the London representative of an English firm of ebonite and vulcanite manufacturers, and invites inquiries for rod, sheet and tube, also battery boxes, telephone fittings and turned and moulded goods. Mr. Blair also represents the Record Engineering Co., Ltd., Manchester, for petrol, paraffin and gas engines, and Messrs. Broom & Wade, Ltd., High Wycombe, for air compressors and hoists.

Liquidation.—THE EUREKA CLOCK CO., LTD.—This company is winding up voluntarily, with Mr. A. E. Tilley, of 8, Staple Inn, London, W.C., as liquidator.

LIGHTING and POWER NOTES.

Aberdovey.—PROPOSED E.L.—The U.D.C. has been recommended to invite competitive schemes for the best means of lighting the town by electricity, generated by water or other power.

Atherton.—L.G.B. INQUIRY.—An inquiry was held here last Friday into an application by the D.C. for permission to borrow £2,100 for the purposes of the electricity undertaking.

Australia.—The Newcastle (N.S.W.) Council during 1913 decided to largely extend its undertaking, but apparently some delay is taking place. A new station site was under discussion, providing for a first unit of 2,000 KW.; the Council has, however, decided to hold this in abeyance, but intends providing a 500-KW. set to meet the winter demand of 1915, and tenders are now about to be called for this plant complete with surface condenser, boilers and other essentials to render it a complete unit. The question of a general extension into the district is, for the time being, also held in abeyance. The principal difficulty, according to Press reports, appears to be that the Council's borrowing capacity is not in proportion to the development of the city, and the Government is to be approached upon the general question of increased powers. The business of electricity supply is steadily developing, and many people appear to be changing over from gas to electric light, while modern buildings are all being equipped for electric lighting, heating and power. The power load in this district should, in the future, be very great, as the new steel works will be in operation early in 1915, and this, it is expected, will encourage the manufacture by the smaller men of many special lines.

Bacup.—STREET LIGHTING.—The T.C. has approached Rawtenstall with a proposal to light Newchurch Road and Market Street by electricity in a similar manner to the Rawtenstall streets.

Bolton.—PROPOSED LOAN.—The Finance Committee has decided to make application to the L.G.B. for sanction to borrow £17,000 for electric cables.

Canada.—A Consular report, quoted by the American *Electrical Engineering*, refers to the Ontario Hydro-electric Power Commission. In addition to the expenditure already made of $5,915,725, the Commission is authorised, says the report, to spend $5,000,000 during the current year in extending the supply of electricity at cost to municipalities for power and lighting. In addition to the 45 municipalities served last year, more than 100 others have asked for estimates for installing plants for the distribution of electric power which will be obtained from the Niagara Falls and other places. By the end of last year 45 municipalities had installed distributing plants at a total cost of $8,469,197 (of which Toronto expended $3,919,810); the total revenue derived therefrom was $2,605,006, and the net surplus $390,012. The municipalities retain part of the revenue as working capital. A compilation of the private electrical corporations in Ontario has been made by the Canadian Electrical Association, which is a branch of the National Electrical Association of the United States. It has been found that the number of plants is 157, and the total capitalisation approximately $108,500,000, which includes the hydro-electric power plants at Niagara Falls. Estimates of cost were made for only a few plants having a capitalisation of something more than $1,000,000. Besides the works of the 157 companies, there are some hydro-electric and other electric power and lighting plants owned by municipalities.

Chile.—Plans and specifications submitted by Don Francisco Soto for the erection of an electric generating station to supply the town of Cartagena with electric light have been approved.—*Board of Trade Journal.*

Chobham.—Proposed E.L.—The P.C. has informed the Chertsey R.D.C. that a supply of electricity for the parish is desirable if obtainable at a reasonable price, and failing the Ascot Gas and Electricity Co. giving a supply at an early date, permission be given for the Woking Electric Supply Co. to extend its mains to Chobham. At a meeting of the R.D.C. on August 18th it was stated that the Ascot Co. had intimated that it intended exercising its powers, and that it would not permit the Woking Co. to give the supply. It was decided to forward the views of the P.C. to the Ascot Co.

Continental Notes.—Norway.—The owners of the electrical power plant at the Solberg Waterfalls to the north of Kristiania, have recently placed an order with the A.E.G. for six 6,250-kw. transformers, oil insulated and cooled by means of compressed air. They will be employed in connection with the transmission of 20,000 kw. to a sub-station at Kristiania; the primary voltage will be about 60,000.

The Skienfjord Municipal Power Co. is obtaining similar transformers, with a total capacity of 42,000 kw., and the Norwegian Hydro Co., transformers with a capacity of 10,000 kw., to be installed at Rjukan II.

Russia.—The Commission appointed in 1909 to inquire into the water-power resources of Russia has occupied itself with the classification of the watercourses available for railway working. Up to the present only rivers have engaged attention, the Dniester being calculated to yield 15,000 kw.; the Niemen, 30,000 kw.; and the big waterfalls on the Szuna 120,000 kw. at most, and 12,000 kw. at least, flow. The cost of construction of the Birschtany power station on the Niemen, of a capacity of 15,000 kw., is estimated at 4,000,000 roubles. The cost of the three power stations at falls on the Szuna, of 20,000 kw. capacity each, is put at 3,000,000 roubles. The output may, however, be raised by the building of a storage dam.

Austria.—Among municipal undertakings in Austria, those for the generation of electricity are most numerous and consequently most important. According to statistics gathered by the Elektro-Technische Verein, of Vienna, there were in January, 1913, throughout Austria 886 electrical concerns working or under construction. Of these, 345, or 39 per cent., were owned by municipal or communal authorities. Similar statistics compiled for Switzerland, give a proportion of 296, or 38·5 per cent., of municipal undertakings in an aggregate of concerns supplying current to third parties of 766. These figures relate to the year 1911.

Donoghadee.—Prov. Order Extended.—The B. of T. has deferred the revocation of the U.D.C.'s E.L. order of 1911 for a further period.

Dublin.—Street Lighting and the War.—The Electricity Supply Committee has decided to curtail the lighting hours. From Monday last, and until further notice, each alternate arc lamp in the streets will be extinguished at 11.30 p.m. This measure, it is stated, is rendered necessary as the result of the limited stock of carbons.

Heeleyfield.—Public Lighting.—The ratepayers have adopted a scheme of public lighting by electricity for the district, including the village of Castleside.

Helsby.—Loan Sanction.—The L.G.B. has sanctioned a loan of £405 for the installation of electric power at the waterworks.

Greenock.—Year's Working.—There was a surplus of £3,463 on the past year's working of the Corporation electricity department, against an estimated surplus of £1,273.

India.—From our contemporary, *Indian Industries and Power*, we gather that preparations for demonstrating the rival advantages of high-pressure gas and electric lighting in the Bombay streets have reached an advanced stage; both illuminants have their partisans in the city. The Simplex Mill, containing 30,000 spindles and 800 looms, which has been converted to electric driving in connection with the Tata hydro-electric supply, was started with a temporary supply from the Electric Supply and Tramway Co.

According to the *Englishman*, nearly the whole of the machinery on the Kolar Goldfields is now worked by steam, owing to the shortage of electric power from the Cauvery power plant.

Irlam.—Proposed E.L.—The U.D.C. has decided to engage an expert to report upon the suitability of the district for electric supply, and to advise the Council as to the promotion of a prov. order for E.L. The Lancashire E.P. Co. has already intimated its intention to apply for an order.

Kingston-on-Thames.—L.G.B. Inquiry.—An inquiry was held on August 20th into the application of the T.C. for a loan of £8,500 for two extra-high-pressure cables, and the erection of a transformer sub-station. There was no opposition.

Liverpool.—Proposed Loan for Mains.—The E.L. Sub-Committee has recommended the T.C. to apply to the L.G.B. for sanction to a loan of £40,000 for new mains.

Mexico.—The *Electrical World* states that owing to the more settled conditions at the mines, the Mexican Northern Power Co.'s 50,000-h.p. hydro-electric plant at Santa Rosalia will now be pushed to completion. Work on the plant was suspended last October, when the hydro-electric plant had been installed and the transmissions nearly completed; in the interval the floods have filled the reservoir, forming a lake 30 miles long and several miles broad.

Middleton.—L.G.B. Inquiry.—Mr. H. R. Hooper has held a L.G.B. inquiry into the application of the T.C. for sanction to borrow £7,610 for extensions at the electricity works.

Rawtenstall.—Plant Extensions.—The electrical engineer (Mr. Stewart) having submitted details of the cost (about £9,000) of the proposed extension of the boiler house at the electricity works and of the new plant required, the Finance Committee has arranged for the provision of £3,500, and that the remainder be taken out of the renewals and reserve fund.

South Shields.—Annual Report.—Mr. Harry Ellis, the borough electrical engineer, records a surplus of £3,522, compared with £3,163 in the previous year, and this amount has been transferred to the reserve fund. In making comparison with the previous year, it should be remembered that £1,081 has been spent out of revenue on connecting new consumers' meters, showroom equipment, &c. The revenue amounted to £33,775, as against £30,341, an increase of £3,433, equivalent to 11·3 per cent. The total costs amounted to £16,821, against £14,895, an increase of £1,926 as compared with the preceding year. The principal item in the expenditure account was for fuel, which cost £996 more, due to increased output and price of coal. The best indication of the business done is the fact that domestic heating and power units increased from 40,584 to 68,443, or 68 per cent., and private lighting increased from 974,285 to 1,063,591, or 9 per cent. The total power connections increased from 4,030 h.p. to 4,461 h.p., an increase of 10 per cent. The supply for traction also showed an increase from £5,924 to £6,952. The gross profit was equivalent to 9·7 per cent. The total number of units sold was 4,569,798. The engineer states that the high c.p. half-watt lamp had enabled them to obtain many consumers for outside shop lighting who were previously apparently satisfied to be without that class of lighting altogether. Although he welcomed the high c.p. half-watt lamp, he should not welcome to the same extent a similar low c.p. lamp, as such a lamp was not needed to enable them to compete for inside lighting, and it would have a serious effect on their revenue. It was more than probable that such a lamp would come, and it was partly on that account that he advised them to do all they could in the way of increasing their business in the direction of power supply and the supply for heating, cooking, and other domestic purposes. To do this they should have powers to hire and sell electrical apparatus, and to carry out wiring work. He recommended them to develop the commercial side of the undertaking as far as lay in their power.

United States.—A permit has been issued for the erection of a power house for the Philadelphia Electrical Co., at Philadelphia, to cost $1,000,000. The building will be equipped with two turbo-generators, one of 30,000 kw. and the other of 35,000 kw. The plant, when completed, will furnish electricity to operate the Pennsylvania Railroad lines from Broad Street Station to Paoli.

Uruguay.—The directors of the Government electricity works have issued their report for the years 1911-12 and 1912-13. The report only deals with the works at Monte Video. For the year ended June 30th, 1912, there was a gross profit of $725,451 gold, and after providing for service on bonds and payment of the amount due to the municipality, there was a net balance of $545,499. For the year ended June 30th, 1913, the gross profit amounted to $934,794; service on bonds to $83,339; the municipality received $250,000, and $35,145 was placed to reserve, leaving a net profit of $516,309. At the end of June, 1913, the total number of lamps in service was:—Incandescent, 331,342; arc, 2,273; various, 3,955; and there were 2,758 motors, with a total of 12,508 h.p. The total revenue was $1,409,423, and the total output was 23,200,228 kw.-hours, as compared with 16,281,410 in 1911-12. The gross revenue for 1911-12 was $1,101,367, and for 1912-13 $1,409,423. Two new Babcock & Wilcox boilers, equal to the eight already existing, have been installed. They are of the marine type, with 400 sq. m. heating surface and a normal production of 900 kg. of steam per hour. The economisers were supplied by Messrs. E. Green & Sons. The boiler house is now able to supply steam for a total load of 9,000 to 10,000 kw., but as the load will soon pass this amount the boiler house is being enlarged. During the year two turbo-generators of 4,000 kw. have been acquired from the A.E.G. These new machines increase the capacity of the station from 6,800 to 16,800 kw., which will be sufficient to meet all demands up to the winter of 1915, when a new group of 8,000 to 10,000 kw. will be installed. The total length of underground mains in June, 1913, was 464,105 metres. Overhead feeders had a length of 84,294 metres and overhead distribution lines amounted to 600,200 metres. During the year ended June, 1912, the consumption of coal per kw.-hour produced was 1·1637 kg., and for the month of June, 1913, 0·97 kg.—*Review of the River Plate.*

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. Cars.—At a meeting of the Corporation the Tramways Committee's recommendation to purchase six new P.A.Y.E. cars, at a cost of £4,284, was sent back for further consideration. Bailie Fiddes said that, as far as convenience was concerned, he was convinced that the P.A.Y.E. system was an absolute failure. Another member said he could not see

why anybody paid more than ½d. in the P.A.Y.E. cars, and that it must only be an excess of conscientiousness, because nobody was obliged to do it.

Australia.—According to the Australian papers, the electrification of the first Melbourne suburban railway line, from Broad Meadows to Sandringham, will not be completed until about November, 1915, which is about six months later than was anticipated. This delay is chiefly attributed to the fact that the tenders for the switchgear, which is of a very complicated design, were not satisfactory, and fresh tenders were invited. The department has been proceeding with the track circuiting of the line on the direct-current system, and it is essential that alternating-current track circuiting be substituted before any stock is used. The site of the power station has also had to be altered.

Blackpool.—War Effects.—The monthly report of the manager (Mr. C. Furness) just issued shows that the tramway receipts were £14,247, against £16,983 in the corresponding period last year—a decrease of £2,736. The passengers carried were 2,000,611, against 2,269,394, and the takings per car-mile decreased from 2s. 6¾d. to 2s 3¾d. The returns for the year are, however, still ahead of last year to the extent of £1,256. In the electricity department the returns were very satisfactory, the output being very much in advance of last year, while there were 170 new consumers, compared with 126 up to the corresponding date last year.

Continental Notes.—Belgium.—According to the daily papers, the Germans in occupation of Brussels each night seized the takings of the tramways undertaking, and the company retaliated by carrying passengers free of charge.

Germany.—The Saxon State Railways have made some successful experiments with a new system of electric traction, suitable for lines with small and infrequent traffic, where a steam locomotive is too costly and an accumulator battery motor is not applicable. The system consists of a combination of a Diesel engine with a dynamo. A six-cylinder Diesel motor was used, working with the cheapest oil, coupled to the dynamo, as a direct drive by the Diesel motor was not found feasible, owing to the high speed of the motor. The dynamo allows a speed of 70 km. per hour with a trailer attached and a passenger load of 80, besides supplying the electric lighting and working the vacuum brakes. A driver and two conductors is all the staff found requisite.

Rawmarsh.—Proposed New Tramways.—The U.D.C. has appointed a deputation to meet the Mexborough and Swinton Tramways Co. with a view to ascertaining whether the company would be willing to provide a double tramway track in High Street, while the proposed improvement was being carried out.

Rochdale.—Loan Sanction.—The Town Clerk has received a notification from the B. of T. that an application for a loan of £17,000 for the erection of a new tramcar shed and workshop at Mellor Street has been sanctioned.

Stirling.—Proposed Tramway Purchase.—The secretary of the Tramways Co. has informed the Town Council that the company is prepared to dispose of its undertaking for £15,000. The T.C. proposes to take over the tramways and electrify them.

United States.—Owing to labour troubles, the electrification of the Chicago, Milwaukee and St. Paul Railway has been indefinitely postponed.

TELEGRAPH and TELEPHONE NOTES.

Canada.—The Government telephone and telegraph system in and around Kamloops (B.C.) is, it is understood, to be reconstructed and extended, at an estimated cost of about $110,000.

Canadian Marconi Stations.—The Government is erecting a new wireless station at Cape Race which will practically double the present radius of that station and render Cape Race the first point of land communication for all vessels sailing from or to North Atlantic ports. The new equipment will have a radius of at least 500 miles, instead of the present normal one of about 250. Even with the comparatively limited radius of the present station, news of the majority of the Atlantic mishaps is now picked up by the Government operators at Cape Race. The new towers will be ready for operation during the present month.—*Financier.*

Chinese Telephones.—The use of the telephone has not developed to any extent in China; long-distance lines, apart from the Pekin-Tientsin line and some railway lines, are non-existent. Local networks exist in Pekin, Tientsin, Shanghai and Canton, which are controlled by the State and associated with the telegraphs. The Chinese Government is understood to favour a great extension of telephone facilities, especially where there is no telegraph, and a number of installations are to be carried out during the next two years.—*Deutsche Vekehr Zeitung.*

Japan.—A wireless telephonic transmission and receiving station is to be established by the Japanese Government at the entrance to Ise Bay, Shiba Province.

New York-Panama Cable.—To provide for the large increase in business which it is expected will follow the opening of the Panama Canal, a $1,500,000 cable is to be laid from New York to Colon, by way of Guantanamo, before the end of the year. Later it may be extended to Brazil. The cable, which is being constructed in England for the Central and South American Telegraph Co., will be much larger than the present cable. The c.s. *Colonia* will leave England in November with the cable, for New York.—*Am. Electrical Review.*

Spain.—The Civil Governor of Barcelona announces that several wireless installations have been dismantled, and only a few of the ships in the port are able to receive messages by radio-telegraphy.—*Standard.*

Sweden.—The B. of T. announces that an order has been issued by the Government of Sweden prohibiting the use of wireless telegraphy on the vessels of belligerent Powers within the radius of Swedish harbour areas.

United States.—The Ohio Public Utilities Commission has approved of the consolidation of 15 of the leading telephone companies in Ohio, and the Ohio State Telephone Co. has been incorporated in accordance therewith. The capital liabilities of the 15 companies are $25,568,000, which will be reduced by $5,396,600 by the consolidation, and $2,850,000 is to be spent on improvements. The new company will control over 250,000 miles of line and 64 exchanges.—*Electrical World.*

It is reported that the U.S. Government has notified the German owner of the Tuckerton wireless station that the licence granted for three weeks' experimental work has expired and that operation must cease. The Tuckerton station has a tower 820 ft. high, and could communicate direct with Berlin.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 9th. Electrical goods, for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager.

Australia.—Sydney.—September 14th. Municipal Council. 22,500 yards of 33,000-volt, three-core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

September 30th. Telephone instruments and parts for Postmaster-General. See "Official Notices" August 21st.

October 7th. Telegraph instruments, measuring instruments, incandescent electric lamps, switchboard parts, for the Postmaster-General. See "Official Notices" to-day.

Adelaide.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., switchboards, bells and cells, for the Postmaster-General. See "Official Notices" July 31st and August 7th.

September 2nd. 6½ tons bare hard-drawn copper cable, for the City Council. See "Official Notices" August 21st.

September 23rd. 102 electric motors, starters, switchboards and wiring for installing electrical drive at Messrs. Sands & McDougall, printers. Mr. M. C. Coates, consulting engineer.—*Tenders.*

Melbourne.—Victorian Railways Department. October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

October 14th. Victorian Railways Commissioners. (1) Low-tension switchgear and instruments, (2) 12,540 yards of low-tension cable, (3) fuse distribution boxes and fuses, and (4) best quality Yorkshire iron forged billets. Specifications, &c., may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*B. of T. Journal.*

Perth.—September 9th. Coin attachments, for Postmaster-General. See "Official Notices" August 14th

Batley.—Electricity Committee. 500 tons of pea nuts or beans and 1,500 tons of best slack coal, for the electricity works. Mr. J. H. Craik, Town Clerk, Town Hall, Batley.

Birmingham.—September 7th. Coal (173,000 tons) for the Corporation Electric Supply Dept. Mr. R. A. Chattock, City Electrical Engineer and Manager, 14, Dale End.

Clayton (Bradford).—September 7th. Electric lighting installation, for the Guardians of North Bierley Union. Specifications from Messrs. J. Harper Bakes & Sons, Calverley Chambers, Leeds.

Dundee.—August 31st. Corporation. Rotary converters, switchgear. See "Official Notices" August 21st.

Huddersfield.—September 9th. West Riding Asylums Board. Electric lighting, telephones, bells, &c., at the new chronic blocks, Storthes Hall Asylum, Kirkburton, near Huddersfield. Particulars from Mr. W. E. H. Burton, Engineer to the Board, West Riding Asylum, Wakefield.

London. — L.C.C. — September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" August 7th.

September 8th. Reconstruction of motor-generators in the tramway southern sub-stations. See "Official Notices" Aug. 14th

September 22nd. Induced-draught fans, motors, spare parts and dampers, also alteration of flues and moving of dampers at the generating station, Greenwich. See "Official Notices" to-day.

St. Pancras.—September 21st. Electric lift for heavy vehicles, for the B.C. See "Official Notices" to-day.

Manchester.—September 15th. Supply and erection of steel storage shelving in the Stores Dept., Hyde Road car depôt, Manchester. Mr. J. M. McElroy, General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

Middlesbrough.—September 12th. Corporation. Three electric motor-driven sewage pumps, priming pumps, metering arrangement, pipework, overhead travelling crane. See "Official Notices" August 14th.

New Zealand.—September 30th. Traction battery for the Dunedin City Council. Specifications from the Borough Electrical Engineer.—*N.Z. Shipping and Commerce.*

Spain.—October 19th. Concession for the construction and working of an electric tramway in the town of San Sebastian. An option on this concession is held by the "Compania del Tranvia de San Sebastian." Tenders to the "Direccion General de Obras Publicas, Ministerio de Fomento," Madrid, accompanied by a deposit of 4,006 pesetas (about £148), which is to be paid into the "Caja General de Depositos."—*B. of T. Journal.*

Torpoint.—September 3rd. Electric light brackets and fittings for public lighting, for the U.D.C. Messrs. Rolands and Beaumont, engineers, Torpoint.

Warrington.—September 11th. Education Committee. Wiring, &c., at the Evelyn Street Council School. Mr. J. Moore Murray, Secretary and Director, Education Office, Sankey Street, Warrington.

September 15th. 12 months' supply of earthenware conduits, for Tramways Committee. See "Official Notices" to-day.

Whitby. — September 30th. U.D.C. Construction of cliff tramway or lift. Particulars from the Clerk to the Council.

Wolverhampton. — September 8th. Construction of tramway permanent-way, Bilston Road, for the T.C. Mr. George Green, Borough Engineer (returnable deposit of £1 1s.).

CLOSED.

Australia.—The N.S.W. Public Works Department has accepted the tender of Messrs. Noyes Bros. (Sydney), Ltd., at £1,290 10s., for lead-covered cables and accessories at the new abbatoirs.—*Aus. Mining Standard.*

London.—L.C.C.—The Council has again placed with Messrs. Siemens Bros. Dynamo Works, Ltd., its contract for the supply of 125,000 tantalum traction lamps. Tantalum lamps have been used for the past two years on practically the whole of the L.C.C. tramcars.

Office of Works.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract for a 12 months' supply of Wotan drawn-wire tungsten lamps for H.M. Office of Works.

Morecambe.—The E.L. Committee has accepted the tender of Messrs. Terry, Greaves & Co. for the supply of coal to the electricity works.

Scarborough.—The Board of Guardians has accepted the tender of the Brightside Engineering Co., at £4,841, and that of Messrs. Jaram, amounting to £1,123, for the heating and lighting alterations to be carried out at the workhouse.

Southend-on-Sea.—The T.C. has accepted the tender of the Oliver Arc Lamp, Ltd., for ten 10-amp. 400-C.P. arc lamps to replace those on the Leas.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, September 5th. Visit to Felling Colliery and Garden Party at Wardley Hall.

Salford Technical and Engineering Association.—Saturday, September 5th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Centrifugal Pumps for Salvage, Sewage and Gravel," by A. W. Taylor.

NOTES.

Miners' Demand for Electric Lamps.—The miners employed at the Glapwell Pit belonging to the Sheepbridge Coal and Iron Co., Ltd., are demanding that electric safety lamps shall be introduced. At the meeting of the Council of the Derbyshire Miners' Association, at Chesterfield, on Saturday, it was stated that another type of lamp had been tried, but it was not satisfactory. The Council gave the men permission to ballot on the question of handing in their notices unless the matter is satisfactorily settled.

Appointments Vacant.—Electrical engineer, age 25-30 (Rs. 500 per mensem), for South Indian Railway; switchboard attendant (30s.) for Portsmouth Corporation; commercial assistant for Bermondsey electricity department (£140 + commission); electrical engineer, under 45 (£500) for Swansea Corporation. Particulars are given in our advertisement pages.

Educational Notes.—Goldsmith's College, University of London.—The new session of the engineering department commences September 21st. Particulars are given in our advertisement pages to-day.

South-Western Polytechnic Institute, Chelsea.—Electrical engineering courses commence September 28th. Particulars are given in our advertisement pages to-day.

Cables in War Time.—As the result of inquiries made on Wednesday as to what submarine telegraph cables were interrupted on that day, we received the following reports:—

Commercial Cable Co.	All intact.
Cuba Submarine Tele. Co. ...	"
Direct Spanish Tele. Co. ...	"
Direct U.S. Cable Co.	"
Direct W. India Cable Co. ...	"
Eastern Extension, Aust. and China Tele. Co.	No information.
Eastern Tele. Co.	" "
G.N. Tele. Co.	No information given.
Indo-European Tele. Co. ...	Interrupted July 31st; this was notified in the papers; interrupted at present.
P.Q.	All working except the Bundaberg (Aus.) cable, but this is probably only a temporary interruption.
S. American Cable Co.	All intact.
Western Union	" "

Ediswan Glass Works.—It has recently been pointed out in the Press that only two electric lamp manufacturers in Great Britain have their own glass houses and blow their own bulbs, and at the present time when Continental supplies are closed down it is particularly interesting to record that the Edison and Swan Co. are the fortunate owners of one of these works, and that all the glass used for Royal Ediswan lamps is made and blown there.

The illustration shows a part of the interior of one of this company's glass houses where experienced glass blowers are seen

View in the Edison & Swan Co.'s Glass Works.

at work. One of the operatives can be seen at the furnace gathering "metal," and two other operatives are seen blowing and finishing the bulbs off in the mould. This class of work is skilled and requires a great deal of experience and careful handling.

The glass houses are kept continuously running; the operatives work in three eight-hour shifts, thus making up night and day.

Considerable extensions to the existing Ediswan glass houses are being made to meet the anticipated increased business which is even now being negotiated on every hand for all-British lamps.

Institution and Lecture Notes.—At the Congress of the South African Association for the Advancement of Science, held at Kimberley, Mr. W. Elsdon-Dew gave a series of statistics relating to the use of electricity on the Witwatersrand. In introducing the subject, Mr. Elsdon-Dew predicted that with the electrification of the railways there would follow the supply of cheap power for the use of the farmer, for ploughing, irrigation, &c. He also mentioned that the load factor on the Witwatersrand mines was generally between 70 and 80 per cent., and that about 2¼ million tons of compressed air was supplied to them.

Inquiries.—A correspondent asks :—"Can you advise us where we can obtain permanent magnets in quantities from a neutral and friendly country?"

Another correspondent writes :—"Would you kindly let us know where we could best get made an electrolyte apparatus for experiments in bleaching with H_2O_2, Fischers' German patent, 8582/13? We are patriotic, and wish to try this. German makers are now out of it."

A correspondent asks for the names of makers of enamelled wire.

Another writer wants the name of some British firms that manufacture jointed or hinged brass lubricating rings. He says that he is looking out for actual British manufacturers and not factors, who generally represent Continental firms.

What Constitutes a British Firm?—The following letter from a member of a well-known firm of consulting engineers reaches us just as we are going to press :—"A good many people have been talking, and I have personally been approached by representatives of firms asking us to stop giving orders to Siemens—because apparently the share register shows that some 90 per cent. of the capital is held in Germany! I may be unjust, but it seems to me to be a mean and dirty suggestion. No firm has done so much during the past 50 years for electrical trade in England and her Colonies as the Siemens have.

"Sir William Siemens was a pioneer in this country; he was everywhere highly honoured, and his support of technical education was considerable. Think of the Siemens Laboratory at King's College also. Alexander Siemens is a universal favourite, and he has been a trusted member of the Institution for many years. Few could have done more than he has for us all, and especially for the engineering trades.

"If Siemens were barred, some thousands of workmen and their families, and many good engineers, would be thrown out of work. All because a few busybodies are afraid that the capital of Wilhelm and Carl von Siemens, and others of the family, might earn a dividend this year!

"If you like you can publish this verbatim, but in any case I wish you could see your way to curb the malicious tongues."

Bradford Electrical Exhibition.—Owing to the war this Exhibition, which was to have been opened on October 6th, has been postponed. A new date will be announced shortly.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Todmorden Council has unanimously agreed to increase, by £25 per annum, the salary of the borough electrical engineer, MR. JOSEPH BOYCE.

MR. A. H. BLAGDEN was to leave England on Saturday last for the Shanghai municipal electricity department.

General.—MR. R. H. SPERLING, on the occasion of his retiring from the post of general manager of the British Columbia Electric Railway Co., Ltd., was presented by the office staff and employés with a solid gold cigar box and a large framed group containing individual photographs of nearly every employé on the North Shore. Mrs. Sperling was the recipient of a five-stone diamond ring enclosed in a gold casket. The presentations were made on Saturday, August 1st, at the Vancouver offices of the company, in the presence of about 400 members of the staff and their families. Every section of the company's field was represented, from Victoria to Chilliwack. Mr. F. S. Barnard made the presentation, and Mr. Sperling, in responding, asked for the same hearty support to be given to his successor, Mr. George Kidd, who had been successful in his previous fields of activity in company work both in London and British Columbia. A farewell banquet was given to Mr. Sperling at the Hotel Vancouver. It was attended by 50 of the leading spirits in the company, and in the course of his reply to the toast of the evening, Mr. Sperling said that it was with deep regret that he was leaving British Columbia, but he felt that in London he might be able, understanding the conditions now prevailing throughout the company's field, to so advise, that the best interests of the company might be served by the action of the London board. From time to time he hoped to return and personally inspect the operations of the company.

MR. A. W. HARRIS, late chief superintendent of telegraphs at Bristol, on leaving to become postmaster at Dover, has been presented by the combined staffs and the telephone department with a silver tea service and silver cigar case.

At Sacriston (Co. Durham), on August 19th, the marriage took place of MR. JOHN PEARSON, chief electrician to the Sacriston Collieries, and Miss J. D. Green, daughter of Mr. Thos. Green, late under-manager of the collieries.

At St. Barnabas' Church, Linthorpe, Middlesbrough, on August 19th, the marriage took place of MR. BARTHOLOMEW SNOWBALL, B.Sc., A.M.I.E.E., of Newcastle-on-Tyne, and Miss Daisy Williams, only child of the late Mr. Thos. Williams, of Cotes Hall, Eccleshall (Staffs.).

The daily Press states that on the retirement of MR. E. CRABB, C.B., second secretary of the Post Office, the Postmaster-General has appointed COL. A. M. OGILVIE, C.B., now third secretary of the Post Office and Director of Army Signals (Home Defence), and MR. H. S. CAREY, C.B., now senior assistant secretary, to be joint second secretaries of the Post Office.

MR. T. H. DENNIS, A.M.I.E.E., is now at home on long leave from Singapore.

On Saturday, 22nd inst., MR. T. C. HODGSON, chief electrician with the Frodingham Iron and Steel Co., who has resigned his position after six years' service, was entertained to a smoking concert at the Queen's Hotel, Frodingham, and made the recipient of a hide suit case and a purse of gold subscribed for by officials of the firm and the electrical staff. MR. C. R. WHITHAM, assistant electrician, was also presented with a gold watch as a token of esteem from the electrical staff. Mr. Whitham has resigned after 24 years' service with the firm. The musical programme was arranged by Mr. O. Hornsby.

MR. LESLIE C. SPEED, electrical engineer, of Southport, is serving with the Army Service Corps.

MR. STEPHEN CORLETT has offered his services as hon. electrical engineer, and also for clerical assistance, to the Wigan Division of the British Red Cross Society.

MR. CHAS. STAFFORD SCHULTZ, a director of Messrs. Dick, Kerr & Co., Ltd., who is a British subject born at Ingersol, Ontario, announces that on August 19th, 1914, he renounced the surname of Schultz, and then adopted the name of Charles Stafford Stafford.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Nairobi Electric Power and Lighting Co., Ltd. (87,728).—Capital, £30,000 in £1 shares (12,000 pref.). Return dated July 22nd, 1914; 12,000 pref. and 17,180 ordinary shares taken up; £1 per share called up on 25,180 shares; £23,180 paid; leaving £2,000 in arrears; £4,000 considered as paid on 4,000 shares. Mortgages and charges: £19,000.

Paignton Electric Light and Power Co., Ltd. (98,437).—Capital, £15,000 in £1. Return dated May 18th, 1914; 11,765 shares taken up; £11,765 paid. Mortgages and charges: £7,500 mortgage debentures and £3,000 temporary loan; list of allotments made up to May 24th, 1914, shows a further 50 shares allotted for cash.

Wellingborough Electric Supply Co., Ltd.—Issue on July 17th, 1914, of £500 debs., part of a series of which particulars have already been filed.

Chesham Electric Light and Power Co., Ltd.—Particulars of £25,000 debs., created July 31st, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

North-Eastern Electric Smelting Co., Ltd.—First mortgage deb. dated August 17th, 1914, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: T. Estall, D. J. H. Cunnick and F. Eley, 15, Bishopsgate, E.C.

A. W. Penrose & Co., Ltd.—Mortgage and Land Registry charge on 9, Little Saffron Hill, London, both dated August 10th, 1914, to secure £2,500. Holders: Bradford Third Equitable Benefit Building Society.

CITY NOTES.

National Electric Construction Co., Ltd.

THE directors report that the gross profit for the year ended 31st December, 1913, was £10,387, and after deducting therefrom expenses of administration, debenture interest, &c., there was a balance of £174, plus £4,472 carried forward at 31st December, 1912, and £2,400 directors' fees for the years 1911 and 1912, which have been waived, making a total of £7,046. Deducting from this £1,550 for the debenture redemption fund, £356 loss on free wired installations sold, and £313, depreciation on rolling stock, Dewsbury and Ossett Tramways, and on furniture, fittings, plant and tools, there was a balance of £4,827, which the directors recommended should be carried forward pending the disposal of points raised in the auditors' report. All the undertakings in operation in which the company is financially interested have made satisfactory progress during the year and the progress was maintained.

RHONDDA TRAMWAYS CO., LTD.—A dividend of 8 per cent. was paid on the Preference Share Capital, being 6 per cent. in respect of arrears for the year 1912 and 2 per cent. on account of the year 1913. The receipts for 1913 amounted to £65,241 as compared with £50,859 for 1912 (the year of the strike).

TORQUAY TRAMWAYS CO., LTD.—A dividend of 5 per cent. was paid on the Ordinary Shares, compared with 3 per cent. for 1912. The receipts amounted to £33,564 against £28,764 for 1912.

Dewsbury and Ossett Tramways.—The profit, after providing for sinking fund and interest payments to the local authorities, and reserves, amounted to £1,232, compared with £917 for 1912. The receipts amounted to £10,207 against £9,552 for 1912.

Mexborough and Rawmarsh Construction Synd., Ltd.—A dividend of 2½ per cent. was paid compared with 2 per cent. for the year 1912. The tramway receipts amounted to £18,348 compared with £16,706 for 1912, and the lighting receipts show an increase of £1,156 over those for 1912.

Musselburgh and District Electric Light and Traction Co., Ltd.—Although no dividend was declared on the Preference Share Capital, an improvement in results was obtained. The tramway receipts amounted to £16,356 compared with £15,412 for 1912. There was an increase in the lighting receipts from private consumers of over £100, and a decrease of about £400 for current supplied to tramway, due to economies in consumption and car mileage.

Town Lighting Installations.—At Bo'ness there was an increase in the gross profit of £597, and at Carnarvon of £202.

Wisbech.—The works are completed and current was supplied on the 31st July, 1914. The number of consumers already connected is highly satisfactory.

Mr. James Taylor and Mr. G. H. Nisbett accepted the invitation of the directors to join the board.

The directors have for some time past had under consideration the need for a revaluation of the company's assets, particularly in connection with the losses incurred with the Folkestone concession. The result of a careful valuation of the whole of the assets of the company is such as to lead the directors to recommend that the £1 shares of the company be reduced to 10s., thus reducing the issued share capital from £170,000 to £85,000.

The annual meeting was held on August 20th, at 3, Lawrence Poutney Hill, E.C., Mr. L. B. Schlesinger presiding.

The Chairman, in proposing the adoption of the above report, said they would remember that last year he informed them that considerable progress had been made with negotiations for an important contract for the construction of an electric railway on the Continent, and that the concession had been granted to a joint board representing some 30 authorities. The Royal Commission appointed by the Government had been designing the sites for the stations, and the president of the committee had come to London to discuss matters, and he stated that directly the joint board was in a position financially to settle the contract, Mr. Cownie, their managing director, would be notified. Last month Mr. Cownie received an invitation to meet the committee at Copenhagen. He was sorry to say that that appointment could not be kept. He could only hope that when the war was over negotiations would be resumed. The other contract he referred to at the last meeting was one which if brought to a successful issue would have resulted in a contract to the company of probably over £300,000. The contract was for an electric light and tramway undertaking in Bagdad. There were certain necessary street widenings to be made by the municipality, but owing to possible financial difficulties the directors of the syndicate decided that the widenings should be undertaken by the company. Negotiations with the Turkish company with that object in view were entered into, and were entirely successful, and amendments to the concession in favour of the company were obtained as a *quid pro quo*. Mr. Cownie was successful in raising the additional capital, and he and Mr. Stanley, the chief engineer of the company, went to Constantinople last April to conclude the negotiations. They formed a Turkish company with a capital of £250,000, 10 per cent. of which was put up by the syndicate as required by the Turkish law. The concession was now the property of the Turkish company, all the shares of which, with the exception of those allotted to the concessionaire, were the property of the syndicate. At the present moment the representatives of a well-known firm of valuers were in Bagdad preparing the estimates for the widenings, but the shareholders would appreciate that there was no question of finance for the time being. He was informed that there was ample time to deal with the business—he believed about a couple of years—although if an extension were necessary, probably in the circumstances there would be no difficulty in obtaining it, as the syndicate had carried out its obligations to the Government by providing the necessary deposit on the capital of the Turkish company. Proceeding to deal with the various undertakings in which the company was interested, the chairman said that the progress was in the right direction. In the case of the Rhondda Tramways Co. the profit earned in 1913 was £27,685 compared with £18,680 in 1912, the year of the coal strike and the strike of the company's employees. The payment by the company of a dividend of 8 per cent. on its preference shares—6 per cent. in respect of 1912 and 2 per cent. on account of 1913—enabled the liquidators of the Rhondda Tramways Co. Construction Syndicate to make a further distribution of 3 per cent., equal to 10 per cent. on the remaining cash invested in the syndicate. The receipts for 1913 amounted to £65,240, as compared with £50,859 for 1912, and to the 17th of August this year there was an increase in receipts of £986. The war, so far, had not had any serious effect on that undertaking. Within the next few weeks it was expected that the railless traction extension would be opened, which would connect important mining centres with the Rhondda, and there was no doubt it would materially increase the receipts. As to the Torquay Tramways Co. his forecast as to the probable results for 1913 were correct, as a dividend of 5 per cent. was paid on the ordinary share capital compared with 3 per cent. for 1912, and a substantial amount was placed to reserve and renewals account. The improvement in receipts had continued up to the date the war broke out, since when, unfortunately, the increase had been turned into a small decrease. The receipts for 1913 mounted to £33,564 against £28,764. The Dewsbury and Ossett Tramways Co. had again reported an improvement in the results of that undertaking. The receipts amounted to £10,207 against £9,552, and after providing for sinking fund and interest payments to local authorities and reserves there was a profit of £1,231 compared with £917 for 1912. There was an increase in traffic receipts to date of £105, but that amount had been turned into a decrease by the end of the year as, of course, trade in the district was now adversely affected. In the case of the Oxford Tramways Company's concessions in which they had a considerable financial interest, the surface contact system failed, unfortunately, before being installed, and as the corporation would not allow over-head wires the horse tramway system had to be kept running. Last December a local man started running motor 'buses without licences, and he had so much support from the residents that the corporation could take no action. Eventually they granted the man 12 licences and 12 to the tramway company. The company was able to put the 'buses on the street, and shortly afterwards, with the approval of the corporation, they purchased the interest in the twelve private 'buses. After long and difficult negotiations with the corporation the tramways company secured an agreement, subject to Parliamentary sanction, for the exclusive right of licences for motor omnibuses in Oxford for a period of 37 years. He was glad to say that the Parliamentary sanction had been obtained, although it met with considerable opposition. The Mexborough and Rawmarsh Construction Syndicate showed a considerable improvement for the year 1913, a dividend of 2½ per cent. being paid as compared with 2 per cent. for 1912. The tramway receipts amounted to £18,347, against £16,705 for the previous year, and there was an increase in the revenue of the lighting undertaking of £1,155, and that progress had been maintained. The accounts for the half-year to June 30th last showed an increase in profits of approximately £600 over the corresponding six months of last year. The construction of the railless traction system to which he referred last year was now being taken in hand, and it was hoped to have the system in operation by the end of the year. In the Musselburgh and District Electric Light and Traction Co. the tramway receipts amounted to £16,356, as compared with £15,411, an increase of about £945, and the progress had been well maintained since; the increase in the traffic receipts to the 17th of this month over the corresponding period last year being £607. Under the new management considerable economies had been effected, and the development of the electric light undertaking well taken in hand, with satisfactory results. As to their town lighting installations an improvement in receipts was shown both at Bo'ness and Carnarvon. At Wisbech the works were completed and current was supplied for the first time on July 31st. Some 70 consumers had already been obtained and the outlook was extremely healthy. In regard to profit and loss account, the profit on contracts was £2,146, against £7,069, a large decrease, but he was glad to say that there was a considerable increase again in contract work this year. Interest on investments amounted to £5,531, compared with £3,452. That was a satisfactory result, and with normal times, he thought, they could look to a steady improvement in that item. The profit for the year was £174, and adding £4,472, the balance brought forward to December 31st, 1912, and £2,400 directors' fees for 1911 and 1912 which had been waived, there was a total of £7,046, and deducting from that sundry depreciations and £1,550 for redemption of debentures, there was a balance of £4,827, which the directors recommended should be carried forward.

Mr. J. Carr-Saunders, J.P., seconded the resolution and the report was adopted without discussion.

Subsequently an extraordinary general meeting was held, when the Chairman proposed a resolution reducing the capital of the company from £250,000 to £125,000, to be divided into 250,000 shares of 10/- each, such reduction to be effected by cancelling capital which had been lost or unrepresented by available assets to the extent of 10/- per share upon each of the 170,000 shares which had been issued, and by reducing the nominal amount of all the shares in the company's capital from £1 to 10/- per share. He explained that the position had been fully discussed at a special board meeting. A careful valuation of the assets had been made, with the result that they had come to the conclusion that £85,000 was ample to be written off. By reducing the capital it would be possible for the board to distribute future profits. Judging from the large number of proxies received the shareholders seemed to be in accord with the directors in their policy, for only one shareholder, holding 240 shares, had written expressing disapproval.

Mr. Carr Saunders seconded the resolution, which was unanimously agreed to.

Continental.—Spain.—La Sociedad General de Tranvias Electricas de Palma is the name of a new company which has lately been formed in Madrid, with a capital of £22,400.

Newcastle and District Electric Lighting Co., Ltd.—The directors announce an interim dividend at the rate of 3 per cent. per annum (3s. per share), less income-tax, for the past half-year.

Llanelly and District Electric Lighting and Traction Co., Ltd.—Interim dividend on the preference shares for the half-year to June 30th at the rate of 6 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

The outlook for the Stock Exchange was naturally not improved by the fall (!) of Namur and the steady way in which the enemy pushes forward in Belgium. While this, of course, does not affect the inevitable end, it tends to delay the final overthrow of the Germans, and to this extent acts as a check upon the revolutions of the wheels both of finance and commerce. According to Royal Proclamation, the moratorium was to come to an end next week, but the general opinion in the City leant to the idea that it would be extended—as to which there will no doubt be some official notification within a few days.

Electric supply companies—at any rate, in the Metropolis—have been amongst the first to recover from the shock of the war outbreak; and they are in the van of the movement set in motion with the intention of turning the national misfortune to the national good. The County of London Electric Supply Company is already in the field with various schemes to enable manufacturers and traders to take advantage of the present position.

Besides pointing out the power supply available, the company, in conjunction with others, offers facilities for charging electric vans for the use of tradesmen in delivering goods within limited areas. The many firms who have had horses and vans commandeered for the use of their country are likely to appreciate such an offer as this, which certainly helps to keep business as usual, and is instrumental in fending off the unemployment, which becomes already a pressing problem.

Stocks and shares are changing hands to a small extent, and we have been able to collect a few quotations. Readers must get tired of hearing that prices are more or less nominal, and this shall be the last time the formula is repeated here. With which preface we may set out the following table, giving the prices which ruled at July 30th, the last day on which the Stock Exchange was opened for business:—

Stock or share.	July 30th.	Present price.
Electric Supply.		
City of London	16	15¾
County of London	12	11½
London 4 per cent. Debenture	92½	90
South London Pref.	5⅝	5¼
Calcutta Electric Pref.	5 1/16	4⅞
Telegraphs.		
Eastern Ordinary	130	130
Eastern Extension	12⅜	12⅜
Western Telegraph	13⅜	13¼
Globe Ordinary	11¼	11
Globe Pref.	12⅝	12⅜
Anglo-American Preferred	108	107
Miscellaneous.		
Anglo-Argentine Trams Debenture	96	94½
Brazil Traction	58	52
Para Electric Railways Debenture	89½	84

Holders of electrical stocks and shares who may wish to realise will find themselves able to do so in a few cases in which the dealers have been short of stock for some time. For instance, Globe Telegraph Preference can be sold easily at very much the same price as prevailed before the crisis; and for quite a number of Electric Supply Debentures there is a demand at a point or so below the last-quoted figures.

It may well be imagined how diverse are people's opinions of what prices ought to be at the present time. One illustration may suffice; and although we should greatly like to mention the name of the shares, the journalistic motto of "When in doubt, leave out," stays the desire. A certain share was quoted at 5¼ on July 30th, and a proprietor of 200 shares happened to want a bid. Some of the regular buyers were approached, of whom all but one declined to make an offer. This one, however, bid 4¼. Five minutes after came along another buyer of 30 shares at 4⅜; and, by odd coincidence, at the end of the day 100 shares were wanted by a provincial centre at 4 1/16. This instance we cite as an example of the difference of opinion there may be as to the war-time value of securities.

The re-opening of the Stock Exchange is a matter which continues to occupy many minds that ordinarily are affected only indirectly by the doings of Throgmorton Street. One of the main difficulties is connected with the matter of loans from banks to Stock Exchange customers. A jobber in the ordinary course of his business will buy, let us say, three or four thousand pounds' worth of stock standing at 105. If it cannot be sold at once, the stock is taken up by the jobber, who, as a rule, puts it into the name of his bank and adds the item to his loan account, secure in the knowledge that he will be able to sell it in a week or two at the latest, and that in the meantime the banker is glad to lend him money on it at a fair rate.

Prices descend, however; the £4,000 stock standing in the loan books of the bank at 105, may be worth 100, 90, or even less. If the banker presented the stock to the borrower and asked him to pay off the loan, the borrower in all probability would be unable to do so, for the item we have quoted is one, say, of 20 others, of larger or smaller amount. To repay the loan would obviously be impossible at a time when nothing can be sold, except in driblets; and the loan perforce must go on. Were the Stock Exchange to be opened, the banker might press for repayment, and the jobber, unable to liquidate his position, be hammered, leaving the stock in the hands of the bank at a price still further depreciated on account of the failure. Multiply this transaction by the thousand, and the amount in similar fashion, and some idea may be gathered of the difficulties which confront re-opening of the Stock Exchange.

The Consolidated Gas, Electric Light and Power Company of Baltimore invites holders of the Preferred shares to exchange these for Common, on the basis of share for share. The company has just raised its dividend on the Common from 6 per cent. to 7 per cent., the Preferred dividend being 6 per cent. The Preferred shares, as constituted at present, are redeemable at the option of the directors, at 120, and the price for the Common shares at the end of July was 105—this however, before the dividend was raised—so there seems to be little object yet in making the exchange; for our part, we would advise proprietors of the Preferred to retain these and to see what happens later on. The last quotation for the Preferred was 114-117, the company's 4½ per cent. bonds, by the way, being quoted at 95.

Amongst provincial companies, the Newcastle and District Electric Lighting Company has declared an interim dividend of 3s. per share on the Ordinary, and the Oldham, Ashton and Hyde Electric Tramways Company announces postponement of the interim dividend on the Ordinary shares, which would have been paid in the ordinary way last week. Amongst the very few shares which have risen since the war started are Birmingham Small Arms, which from 42s. have improved to about 46s. Other armament issues are steady.

To what extent the moratorium in the Argentine Republic and the financial crisis in Brazil will affect payment of interest and dividends on stocks and shares in British companies working in South America, has not yet been defined. The trouble lies in transmitting money from the various countries to this side. Exchange rates are quoted, but in such nominal fashion that transactions are of the day-to-day—or, rather, hour-to-hour—variety. The Brazilian Traction Company has announced its intention of paying a regular quarterly dividend at the rate of 6 per cent. on the common shares, the declaration having a decidedly steadying effect upon the price.

Affairs in Mexico seem to be settling down somewhat, and for some of the railway stocks and shares better prices are quoted than prevailed a week ago. The improvement has not yet spread to the issues of the utility companies, but holders of these can await the future with more composure than many others. A man came in the other day, and said that he had fled from Mexico a year ago because of the gravity of the outlook there, but that now he was thinking of going back, because conditions appeared to be more settled in that country than in this.

The rubber market is weak as regards prices, but strong in confidence. Many of the plantations have already partially closed down, while the demand for the produce has been stimulated by the transport of guns, wagons and all kinds of vehicles used in motor-work on active service, both abroad and at home. The price of the stuff has crept up from 2s. 2d. to nearly half-a-crown per lb., and within the past few days there have been a fair number of dealings in the leading shares, although at prices well under those which ruled three weeks ago.

Lobito Benguella and Catumbella Electric Light and Power Co., Ltd.—This company has decided to divide its capital into 100,000 ordinary and 100,000 six per cent. preference and participating shares, and to create 12,000 five per cent. first mortgage debenture bonds of £10 each. The last-named will be used first to provide further working capital, and then to paying amounts due to pre-prior and prior lien debenture stockholders, to whom fully-paid preference shares will be allotted in part-payment.

Parsons' Foreign Patents, Ltd.—The dividends sanctioned for the year ended June 30th, 1914, are at the rate of 19½ per cent. on the ordinary, 9s. 9d. per share on the deferred shares. Of these dividends, 10 per cent. is payable forthwith on the ordinary and 5s. per share on the deferred, the balance being payable when the directors consider advisable, bearing in mind the present necessity for conserving cash resources owing to the general position in Europe.

Aberdeen Suburban Tramways Co.—The directors report a profit for the half-year of £1,650, bringing the balance at credit of profit and loss account to £4,104. They propose to add £2,000 to renewal and depreciation account, making it £14,000, and to pay a dividend of 2½ per cent. for the year, absorbing £781. The sum of £1,293 would be carried forward.

Potteries Electric Traction Co., Ltd.—A financial paper states that the directors, in view of the existing state of war and the consequent necessity of conserving the resources of the company, have decided to postpone the interim dividend on the 6 per cent. cumulative preference shares, which would in other circumstances have been paid on August 15th.

Stewarts & Lloyds, Ltd.—The directors have declared interim dividends for the half-year ended June 30th last at the rate of 6 per cent. per annum on the preference shares, 10 per cent. per annum on the preferred ordinary shares, and a dividend of 6d. per share on the deferred shares, payable August 31st.

Stock Exchange Notice.—An application for an official quotation has been made in the following:—Montana Power Co.—$10,000,000 5 per cent. first and refunding mortgage sinking fund gold bonds.

Mackay Companies.—The regular quarterly dividend of 1¼ per cent. on the common shares is to be paid on October 1st.

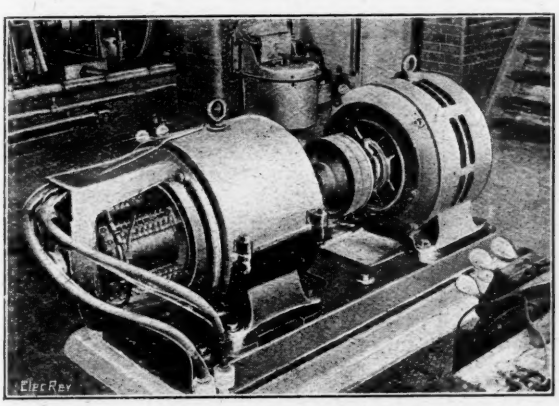
THE CARNARVON WIRELESS TELEGRAPH STATION.

We are indebted to the *Wireless World* for the following description of the new station for trans-Atlantic wireless telegraphy recently erected by the Marconi Co. for communication with the United States.

The stations are situated in North Wales and in New Jersey, U.S.A., and private landlines will connect these terminals with London and New York.

The transmitting section of the British station is situated a few miles east of Carnarvon, on the Cefn-du Mountain, the station building being about 680 ft. above sea level. The receiving section is at Towyn, about 62 miles by road from Cefn-du.

The transmitting and receiving sections are separate to enable duplex wireless telegraphy to be effected. It is not usual to have so large a distance separating the two sections, but it was necessary to do so in this case owing to certain geographical features. In duplex working the receiving section must be placed in a certain definite direction with respect to the transmitting section, and



50-kw. Motor-Generator Set, Carnarvon Wireless Station.

here the correct angle could not be obtained with a suitable site at a nearer distance, owing to the configuration of the country.

There are four wires connecting the two stations, carried on the same poles as the Post Office telegraph lines.

The transmitting station consists of one large building measuring approximately 100 ft. by 83 ft., which is divided into three sections, known as the main machinery hall, the annexe, and the extension.

In the main machinery hall are located the transmitting sets, switchboard, transformer room, stores, offices, and emergency operating room. Auxiliary plant, consisting essentially of electrically-driven blowers, D.C. generators, ventilating fans, and some small motor generator sets used in connection with the signalling circuit is placed in the annexe, which also provides an office for the shift engineers and accommodation for the fitting shop.

The extension is devoted entirely to experimental apparatus.

On the two upper floors of the north end of the building are arranged most of the actual wireless apparatus, consisting of condensers, bus-bars, jigger, and inductances.

The main transmitting sets are in duplicate, each set comprising a 300-K.V.A. single-phase alternator, generating at 1,750 volts and 150 frequency, directly coupled to, and driven by, a 500-B.H.P. three-phase, self-starting motor, suitable for 440 volts and 50 frequency; this in its turn is directly coupled to a shunt-wound exciter giving 300 amperes at 40 volts.

The alternator is directly coupled to the discharger, which is of the rotating disk type, the coupling being an insulated one. Lubrication throughout the entire set is forced. The disk discharger is enclosed in a sound-proof room.

An insulated foundation is provided for the disk, and should it be required at any time to run this asynchronously, an independent 50-H.P. 110-volt shunt motor, having a quickly removable insulated coupling, is provided for the purpose.

The main switchboard consists of 10 panels, each 2 ft. wide and 8 ft. high, upon which are mounted the necessary instruments and circuit-breakers and switches for the control of the various parts of the plant. The mains and main motor panels are provided with time-limit relays; the cables from the switchboard to the various machines are all lead-covered, and are suspended on racks on the sides of the trenches.

In the transformer room are transformers each having a capacity of 75 K.V.A., as well as low-frequency inductances. There is an electrically-operated safety switch in the transformer primary circuit which is controlled by a master switch. Each transformer is provided with isolating switches in both primary and secondary circuits, carried by an iron framework immediately over the transformers. The low-frequency inductances are arranged to facilitate adjustment of the amount of inductance required.

In the emergency operating room is all the apparatus necessary for transmission and reception from the transmitting station instead of from the distant operating station. In addition there is a master switch, under the control of the operator, which automatically operates (1) the safety switch in the transformer room; (2) the receiving aerial isolating switch; (3) the receiving crystal protecting switch; (4) an illuminated sign "Ready to Transmit," situated in the shift engineer's office, and (5) a disconnecting switch in the main earth lead, to unearth the aerial when required for receiving, thus completely avoiding any possibility of damage to the receivers when the aerial is required for transmitting.

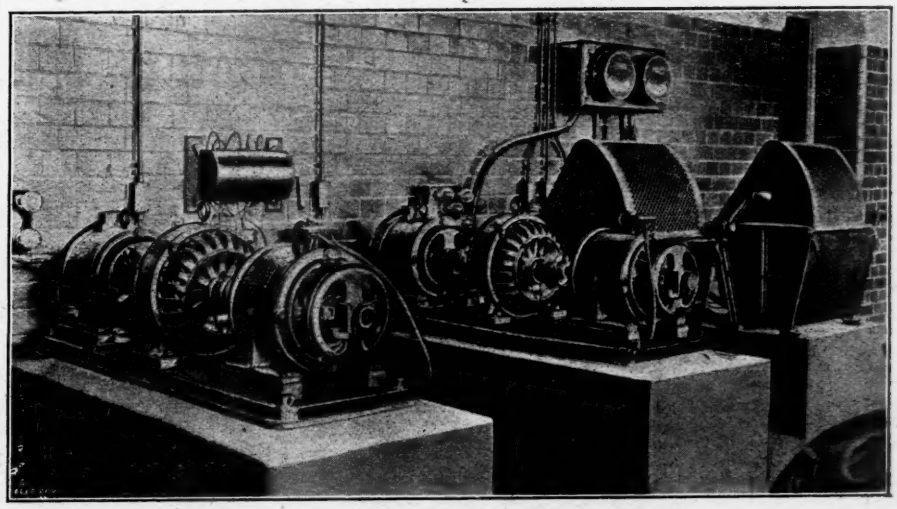
The auxiliary plant is situated in the annexe. Here are motor-generator sets in duplicate, each consisting of a three-phase induction motor directly coupled to a 50-KW., 110-volt, shunt-wound, D.C. generator, in connection with which is used an automatic pressure regulator. The blowers are also in duplicate, each set consisting of a positive rotary blower of the out-board bearing type, driven through spur gearing by a motor suitable for 440 volts, three-phase, and 50 frequency. Air is conducted to a reservoir, and thence distributed where required. The disk discharger chambers are ventilated by means of exhaust fans, each driven by a three-phase induction motor. Duplicate signalling circuit motor-generators are provided, each consisting of a three-phase induction motor running at 1,460 R.P.M., directly coupled on either side to a D.C. shunt-wound protected type generator. Liquid starters for use in connection with the auxiliary disk motors are supplied in duplicate, to guard against any possible temporary interference of the service.

From the shift engineer's office, which is partitioned off from the annexe, an uninterrupted view is obtained of the machinery hall, main switchboard, and the auxiliary plant.

The repair shop is capable of dealing with almost any class of repair work likely to be required, and is equipped with modern power-driven tools.

The latest type condensers are installed, the banks being arranged symmetrically on two floors. The pots are used three in series.

The bus-bars are of copper-sheet, stiffened by Duralumin angle plates; they are supported on standards and separated by means of porcelain insulators. The main bus-bar is extended beyond



Signalling Motor-Generators, with Starters for Disk Motors on the Right.

the condenser banks, and divides immediately over the disk chambers, the ceiling of which is provided with specially-insulated glands, through which pass the main connectors conducting the current from the condenser bus-bars to the side disks. Each branch of the main bus-bar is connected up to one transmitter by means of quickly removable change-over links.

The jigger, of the usual independent primary and secondary type, consists of a suitable number of turns of special H.F. cable, wound

on insulated frames, which are supported so that their axes lie along the axis of the windings. Provision is made for one of these frames to be easily movable in a line along its axis, for the purpose of varying the coupling between the primary and secondary.

The aerial tuning inductances are three in number, and are provided with the necessary tappings for tuning purposes. The aerial is of the directional type, and extends from the building in an easterly direction up the mountain side. It is approximately 3,600 ft. long, and averages 500 ft. in width. Ten tubular masts support the aerial, and these are arranged in four rows of three, two, two and three, each row being 900 ft. apart. The aerial diverges from the leading-in insulator to a line of rod insulators supported by the triatics between the tops of the first row of three masts, thence to the triatic supported by the other rows in succession, the plane of the wires following roughly the contour of the mountain at a height of just under 400 ft. Even tension is kept in every wire by means of a balance weight, thus minimising the possibility of breakage of wire due to wind pressure.

The earth system is briefly as follows :—A ring of metal plates is buried in a circle, with the building as centre. This is connected by means of radial wires with another ring of larger radius. From the outer ring wires are run to the end of the aerial, whilst from the first circles of plates wires are brought overhead to the common earth wire. On two opposite sides of the building are earth terminals, passing through the wall to which the common wire is connected.

There are 10 tubular steel masts, each 400 ft. in height, the lower half being 3 ft. 6 in. in diameter, and the upper half, 2 ft. 6 in. The lower half is built of quarter sections, or quadrants, each 15 ft. in length, and the upper half is built of semi-circular sections, each 10 ft. in length. All the sections have outside flanges, by means of which they are bolted together. Each mast is provided with a gallery at the top, which can be reached by a ladder running up inside, access to the ladder being by means of a manhole. The triatics are attached to a halyard passing through a block at the top of the mast, and another at the bottom, and are made fast to bollards. A winch with warping drums is placed between each two masts. The foundation plate for each mast stands on a block of concrete measuring approximately 12 ft. × 12 ft. × 6 ft., and weighing approximately 48 tons.

Four sets of seven stays of 3-in. steel wire rope with solid core are used for each mast. A stay is insulated about every 100 ft. of its length. The stay anchors consist of concrete blocks measuring about 12 ft. × 12 ft. × 12 ft., and weigh approximately 97 tons. The intermediate pairs of masts are provided with back stays in order to lessen the strain on the mast-head caused by the greater length of triatic which they support.

Power is supplied to the station by means of an overhead transmission line which provides a three-phase supply at 10,000 volts. The power station, belonging to the North Wales Power and Traction Co., is situated at Cwm Dyli, about 11½ miles distant. The prime movers are high-pressure water turbines, the water being obtained from a lake on Snowdon. There is a transformer station adjacent to the wireless station, where the voltage is reduced from 10,000 to 440 volts, at which pressure it appears on the main switchboard.

At the Towyn station the receiving aerial is supported by five masts, each 300 ft. high ; these masts are erected on a range of hills at the back of the town, the last mast being about 1,400 ft. above the sea level. A balancing aerial is also provided carried on 80 ft. poles, the purpose of the balancing aerial being to balance out the effect of signals transmitted from the stations at Cefn-du, so that the signals received across the Atlantic are not in any way affected by the signals from the transmitting station at Carnarvon.

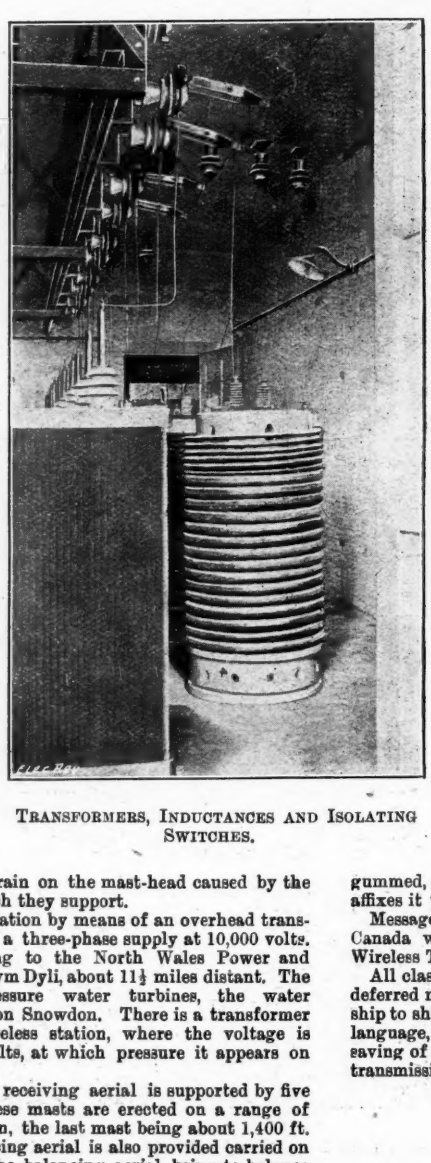
The station is equipped with all the latest types of receiving apparatus, and the operating building has been designed to accommodate sufficient operators to deal with a traffic of 100 words per minute duplex. The operators for both stations are all located in the various operating rooms at the Towyn station, as are also the operators for working the landlines.

The signalling switches at the transmitting station are controlled from Towyn, where the punched tape from the Creed instrument is put through a Wheatstone transmitter, which, by means of relays at the Carnarvon station, actuates the signalling switches, making and breaking 300 KW.

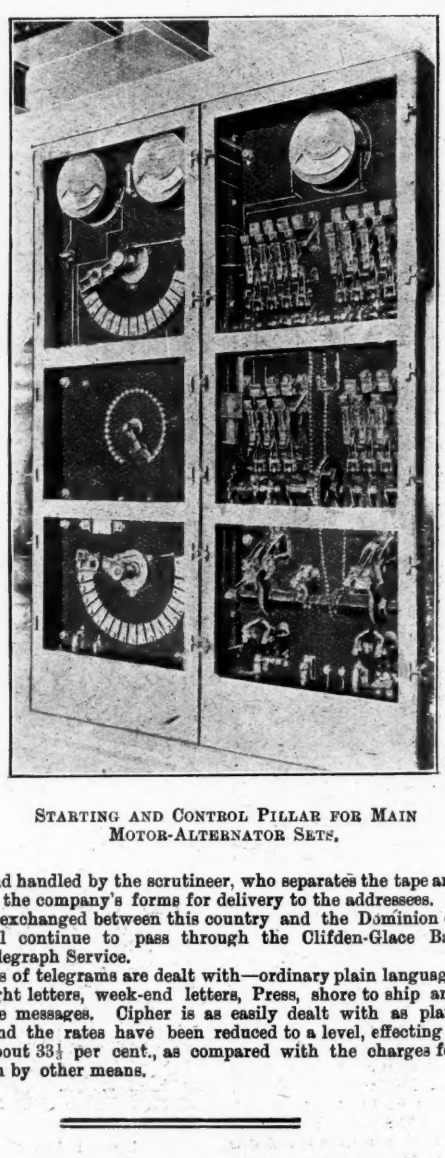
The Marconi Co. have opened large new premises at 1, Fenchurch Street, London, E.C., which serve as a main telegraph office. The new premises are connected by direct landlines with the company's offices at Marconi House, Strand, London, W.C.

To ensure an uninterrupted public service and to provide against the risk of fire, the landlines connected to both the Welsh and Irish stations can be worked either from the office in the Strand, or from the main office in Fenchurch Street.

A telegram, immediately it is handed in, is dispatched by a special tube leading from the public office to the instrument room, where it is transferred to punchers. Then it is passed to the man in charge of the Creed transmitter on the next table, which automatically reproduces punched tape at the high-power wireless at Towyn. There another operator transfers the tape to the wireless transmitter by means of which the dots and dashes are flashed into space and received at the station in New Jersey. Here expert telegraphists transcribe and hand the messages to the landline system connecting with all the important cities and towns in the United States and Canada. The same operation is repeated when a message is transmitted from the United States to England—the only difference being that in London the signals, by means of the Creed printer, are recorded in letters on tape, which is automatically gummed, and handled by the scrutineer, who separates the tape and affixes it to the company's forms for delivery to the addressees.



Transformers, Inductances and Isolating Switches.



Starting and Control Pillar for Main Motor-Alternator Sets.

Messages exchanged between this country and the Dominion of Canada will continue to pass through the Clifden-Glace Bay Wireless Telegraph Service.

All classes of telegrams are dealt with—ordinary plain language, deferred night letters, week-end letters, Press, shore to ship and ship to shore messages. Cipher is as easily dealt with as plain language, and the rates have been reduced to a level, effecting a saving of about 33⅓ per cent., as compared with the charges for transmission by other means.

Electric Vehicle Association, U.S.A.—The tentative programme of the fifth annual Convention of the Electric Vehicle Association of America, to be held at Philadelphia, October 19th—21st next, has been arranged. In addition to the presidential address, 28 reports are to be presented, including a dozen sectional reports, also eight papers dealing mainly with the electric truck for general industrial purposes, postal and fire services, &c. Additional papers are to be announced, and further particulars may be obtained from the Executive Secretary, Electric Vehicle Association of America, 29, West 39th Street, New York City.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AUSTRALIA, 1914.

Irrigation Dams and Hydro-Electric Power.

By E. Kilburn Scott, M.I.E.E., A.M.Inst.C.E. (Lond.).

Read in Section G (Engineering).

One of the most attractive developments of modern engineering is the building of large irrigation dams and the utilisation of the water not only for irrigation, but also for developing hydro-electric power. It is a world-wide development, as may be seen by the locations of dams where such a combination is already at work, or where it is likely to be carried into effect in the near future.

Power generated by the water may be used for a domestic supply of electricity to neighbouring towns, or may be used for the manufacture of such products as fertilisers.

The power may also be used for extending the irrigation area—(a) By pumping water to high lands which cannot be reached by ordinary gravity canals; (b) by draining low-lying

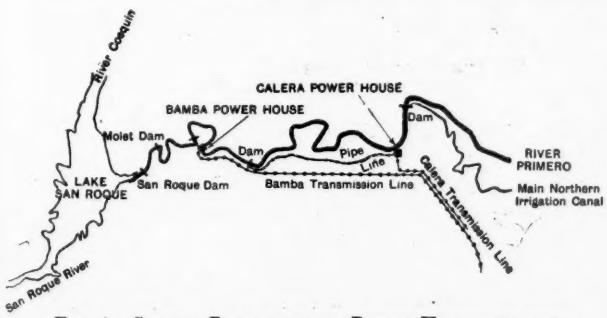


Fig. 1.—Sketch Plan showing Power Houses of the Cordoba Light, Power and Traction Co.

land, the water being raised into gravity canals; (c) by pumping water from wells.

One of the earliest examples is in Argentina, where the Cordoba Light, Power & Traction Co. has for the last 15 years used water from an irrigation dam which was built over 20 years ago. It is a great tribute to South American enterprise and Government that so long ago, a dam impounding two and a half times more water than the then largest one in Europe should have been built for such a purpose as irrigation, and also that in the comparatively early days of hydro-electric development, the water should have been harnessed for power.

As very little information has been published regarding this installation, the following particulars may be of interest.

The irrigation dams utilised by the company are situated about 1,060 feet above the sea, and the main San Roque dam impounds 253 million cubic metres of water. The drainage area is 520 square miles.

The first power house was erected 15 years ago at Bamba, a short distance below the dam (see Fig. 1.) At this point the river has a loop 3½ kilometres long with a very narrow neck. A tunnel 86 metres long was cut through hard granite to connect the two ends of the loop, thus securing an available head of about 31 metres.

The hydraulic capacity of this installation is based on a minimum flow of 15 cubic metres per second. The tunnel has a cross section of 8½ sq. metres, and the maximum velocity is 1.75 metres per second. At the lower end of the tunnel there is a forebay, and the flume pipes from this point down to the power house are 2½ metres in diameter and about 55 metres long, making an angle of 31 degrees.

The power house contains seven McCormick turbines coupled to three-phase generators having a total capacity of 4,000 kw., at 700 volts, 60 cycles. Step-up transformers raise the pressure to 11,000 volts.

Two years ago a second power house was erected at Calera (see Fig. 1). Below the tail race of the Bamba plant part of the flow of the river is diverted to a canal and siphon pipe line 4½ kilometres long to the power house reservoir. This gives a static head of 43 metres, with a working head of about 41 metres.

The power house is equipped with four Escher Wyss turbines capable of developing 1,870 b.h.p., each coupled to a 1,100-kw. three-phase alternator wound for 11,000 volts, 60 cycles.

Both these power houses are connected to a sub-station at Rebaje in the City of Cordoba by means of 11,000-volt overhead transmission lines 15 miles long. From the sub-station current is distributed for light and power in the City of Cordoba in addition to supplying energy for the tramways in the district. As a stand-by there is a steam station in Cordoba having a capacity of 2,200 h.p.

As the water has to be subservient to the requirements of irrigation, about 34 per cent. of the entire rainfall over the catchment area goes to the river, and only about 17 per cent. is available for power. There is, however, a further proposal to build a third hydro-electric power house.

It should be specially noted that the above power houses do not have to contend with a variable head of water as in certain other irrigation schemes referred to below.

Californian Irrigation by Pumping.—In California a unique combination of hydro-electric power and irrigation has been in operation for the last 14 years. Electric energy generated in numerous power houses using high head falls in the Sierra Nevada mountains is transmitted to farming centres where the climate is too dry to make fruit growing practicable without irrigation.

All the hydro-electric power houses in California are linked together by an immense high-tension busbar network, and in some cases the current for irrigation pumping may be transmitted 50 or more miles.

The water is pumped from water-bearing strata which average about 50 feet below the surface. The wells are about a mile apart, and they are each equipped with a 3-phase motor driving a centrifugal pump by means of a vertical shaft.

A 30-h.p. motor will irrigate one square mile of land, the average lift of the water being about 25 feet and the delivery about 3½ to 5 cub. ft. per sec. One man attends to from 8 to 10 wells, which he visits twice a day. By this means barren territory has been made into valuable farm land, yielding rich crops of forage, oranges, lemons, grapes, etc.

Two-thirds of the whole water supply of Southern California is obtained from wells, all of which is pumped by electric power. The water plane is kept about 50 feet below the surface, which results in good drainage and improves the surface soil, for it has been found that it is the rising of ground water and consequent evaporation that increases the deleterious salts and damages land.

Although this method of irrigation is only in use in the States, there must be many places in the world where there are similar geological and climatic conditions. In the Sydney *Daily Telegraph* of December 16th, 1906, I drew attention to this method, pointing out that it might be suitable to certain parts of Australia.

United States Reclamation Service.—Of the high dams built by the United States Reclamation Service the Roosevelt dam, in Idaho, already has a hydro-electric plant. Other large dams built for irrigation are the Elephant Butte or Eagle dam in Arizona, and the Arrow-rock dam in Idaho, and in both these provision for hydro-electric development has been made and plants will be erected as soon as local power demand warrants the expenditure.

The Roosevelt dam measures 1,080 ft. long by 284 ft. high, and about 90 per cent. of its full capacity is held above the 110-ft. level. Although the total head when full is 226 ft., the turbines are designed for a regular operating head of 160 ft. The power house is 125 ft. by 38 ft., and contains six vertical turbines each driving a 1,200-kw. three-phase alternator, 2,300 volts, 25 cycles.

A separate transformer house steps up the pressure to 45,000 volts, at which voltage some of the energy is transmitted to the town of Phornex, 65 miles away. It is contemplated, however, that in the future practically all the power will be used for irrigation.

On the Pima Indian Reservation, 10,000 acres of land are supplied by water pumped from wells by ten electrically-driven pumps similar to those used in California. Eventually there will be about 100 such pumping equipments.

Messrs. O. H. Ensign and J. M. Gaylord, of the U.S. Reclamation Service, give the following very interesting figures regarding this plant:—

The first cost of ten wells and pumping equipments is £20,000, or £2 an acre for the 10,000 acres of irrigated land. The duty of each 50-h.p. pumping unit is 5 sec. ft. for a 55-ft. lift, and at 70 per cent. efficiency, and working 200 days and 24 hours a day, the annual consumption of electric energy is 2,208,000 kw.-hours. The annual cost of this electrical energy is £6,800, or under £7 per acre per annum for the 10,000 acres.

In other words, 24,000 acre feet of water is lifted an average of 50 ft. at a cost of £6,800, or under 6s. per acre foot.

Another interesting irrigation project of the Reclamation Service is that of Minidoka, in Idaho. It comprises 130,000 acres, of which about 80,000 acres are irrigated by gravity canals and the remainder by water pumped from the gravity canal. The power plant is situated at the irrigation dam at Lake Wolcott, and the static head is 46 feet. The power house contains five 1,400-kw. turbine generators, 60 cycles, and two 120-kw. exciter units. The three-phase current is raised to 33,000 volts and transmitted to three pumping stations of 2,500 kw., 3,000 kw., and 1,300 kw. respectively.

No. 1 station has four pumps, each driven by a 600-h.p. motor, and one driven by a 380-h.p. motor. The pumps are of the centrifugal type and are driven by vertical shafts, the motors being on an upper floor.

Assuan Dam Proposal.—This is one of the most interesting irrigation dams in the world, not only for the engineering skill displayed in the building, but on account of its remarkable economic effects on Egypt.

It has been an expensive dam to build, because of its great length, 6,562 feet, the large number of sluices, and the fact that it has been built in two stages.

Nevertheless the tremendous expenditure involved has been found to be more than justified in the irrigation results alone.

The financial results are, however, capable of still further improvement by harnessing the water which passes through the sluices at certain times of the year.

If all the water of the Assuan dam could be utilised the powers and heads of water at various times of the year would be about as follows:—

	Horse-power.	Head.
May	200,000 ...	26 metres.
June	850,000 ...	24 ,,
September ...	39,000 ...	3 ,,
December ...	190,000 ...	5 ,,

The actual possible utilisation of the power depends to a great extent, however, on the fact that the basin on the up-stream side of the dam has to be kept free from silt, and this necessitates opening certain sluice-gates at particular times of the year, so as always to have a high-velocity current cleaning some portion of the basin.

One of the proposals before the Egyptian Government is to harness the water passing through ten of the sluices at the western end of the dam. It is estimated that this amount of water will develop about 100,000 H.P. with a head of 24 metres, and this higher power would be available for about eight months of the year. With the lowest head of 3 metres the power comes down to about 10,000 H.P. It may be mentioned that one estimate of the power from the ten sluices gives it at 80,000 H.P.

Each of the ten turbo-generators will give about 10,000 H.P., and it is suggested that the machine should generate at 11,000 volts and 25 periods per second. The pressure at which it is possible to generate directly depends to some extent on the moisture in the air, because nitric acid tends to form on the high-tension windings. There is usually a good deal of moisture in the air near irrigation dams, and this is particularly the case at Assuan.

There are two problems in connection with the Assuan scheme. The first is to find some industry which can not only be easily worked in such a hot climate and in so remote a situation, but which can economically utilise electric power for, say, only eight months in the year.

The second problem is how best to generate a constant voltage and constant periodicity from a water power the available head of which varies in the ratio of about 8 to 1.

The scheme of Messrs. Harper Bros. proposes to develop 10,000 H.P. for pumping purposes continuously, and to develop up to 100,000 H.P. for making nitrates during the eight high head months of the year.

If the turbines are fixed at the ends of the present sluices then the walls of the sluices will have to withstand pressures that do not occur at present, so they will have to be lined with steel. This shows how very important it is to take into consideration the question of hydro-electric power development when building irrigation dams.

Escher, Wyss & Co. have suggested that instead of building the turbines into the present sluices a separate power house be provided below the dam. A special advantage of this would be that each alternator could be driven by several turbines on one horizontal shaft, and therefore the speed could be much higher.

Working with Variable Heads.—The problem of driving electric generators from water powers of widely varying heads clearly becomes more important every day, because of the increasing use that is being made of irrigation dams and of water powers on rivers, etc., which have widely varying heads owing to floods.

For heads varying to 2 or 3 to 1, or, say, 150 feet down to 50 feet, the difficulty can be met by a suitable design of turbine, although, of course, the turbine cannot work so efficiently as when it is under a constant head

For constant voltage and periodicity the turbine has to run at a fixed speed to suit the lowest head, and above that the extra head is lost. Of course, less water is required at the higher heads, but the power possibilities of the dam are reduced considerably.

It is specially important to note that when the supply of electricity is required for domestic purposes the voltage and periodicity must be constant, whereas if the electricity is used for certain electrochemical purposes there is a good deal of latitude. For example, the direct method of fixing the nitrogen of the air can be carried on at various voltages and periodicities by slight adjustment of the furnace.

A method which has been considered for Assuan is to have two electrical generators and one turbine, as shown in fig. 2. The large alternators are to be mounted on the top of vertical shafts, umbrella fashion, and the small alternator is to be horizontal and driven by bevel gearing from the turbine shafts. When the large alternators are connected to the circuit the small alternator is thrown out of use by moving the pinions out of gear. When the small alternator is in circuit the large alternators run round as well, and merely act as flywheels. Of course, when the small alternator is in use the turbine speed is reduced.

It is of interest to know that Mr. Blathy has developed an electrical method which is going to be applied to a hydro-electric power on the Danube, where the ratio of head of water is even greater than at Assuan.

Just as with three-phase machines, variable speeds can be obtained by altering numbers of poles, so periodicity might be kept constant at variable speeds. For example, it is possible to cause the rotating polarity of a stator or armature to vary relatively to the rotating polarity of the moving portion of the machine.

Australian Conditions.—The geological configuration of certain mountainous parts of the world is especially favourable to conservation of water. The ideal condition obtains when

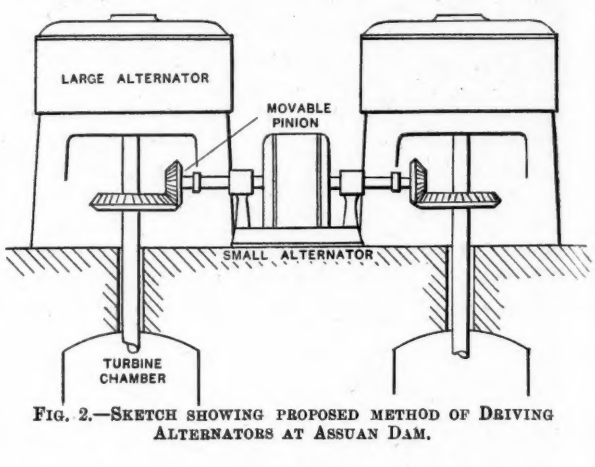


FIG. 2.—SKETCH SHOWING PROPOSED METHOD OF DRIVING ALTERNATORS AT ASSUAN DAM.

a large valley opens out through a narrow gorge on an extensive flat plain. This happens to be a condition fairly frequently met with in some parts of the United States, and especially in Australia.

Mountainous regions where the hills are either peaky or well-rounded are not nearly so favourable to water storage as the peculiar geological formation of the Australian mountains. This may be readily understood by noting the comparatively short lengths of the Cataract and Burrenjuck and other dams of Australia as compared with the volumes of water which they respectively impound.

The water of the Burrenjuck dam is gravitated to the farms without large balance dams, as at Cordoba, but as Burrenjuck dam is over 160 feet high, it should be capable of developing a fair amount of power. Something ought to be done to harness the water if for no other reason than that the sale of the power would assist in meeting the interest and other standing charges.

In the *British Australian* of September 28th, 1911, I wrote an article dealing with the subject, in which I said:—

"The very high concrete dams which are now being built in Australia, as, for example, that of Burrenjuck, will not only conserve great quantities of water for irrigation purposes, but the same water can also be made to develop power. The power will not be so large as some non-experts think, but it should certainly amount to quite a respectable figure, and be well worth harnessing."

There is no better way of investing public money in Australia than in the conservation of water. Consideration of water storage ought really to precede that of pioneer railways, as otherwise a railway may be built and a township grow up in a valley which ought to be submerged. This happened, for example, at Trawool.

Trawool Dam Scheme.—About eight years ago I collaborated with Messrs. J. M. & H. E. Coane, of Melbourne, in working out the details and financial particulars of a combined irrigation and electric power scheme known by the name of Trawool. That name was taken from the proposed site of the dam on the Goulbourn River, about 70 miles from Melbourne.

The dam was to be 1,800 ft. long and 180 ft. high, and it was estimated that it would impound about 70,000 million cubic feet of water, or about 2,000 million cubic metres. The artificial lake so made would have covered 25,000 acres to an average depth of 60 ft.

Its storage capacity as compared with dams in other parts of the world may be gathered from the following:—

Name of Dam.	Country.	Storage in millions cub. metres.
Mohnetal	Germany	130
Edertal	Germany	202
San Rogue	Argentine	253
Pathfinder	Wyoming, U.S.A.	1,234
Roosevelt	Idaho, U.S.A.	1,730
Assuan	Egypt	2,300
Eagle	Rio Grande, U.S.A.	3,100

The site is favourable for building a dam because the foundation is sound silurian rock, while for the construction there are large quantities of solid granite lying close at hand, and at a higher level.

A large part of the ground to be submerged by the dam consists of the Goulbourn river and its branches and of swampy land which is of no use for agriculture. A certain amount of good land would also have to be submerged, but the loss would be much more than balanced by the enormous increase in productiveness conferred on the immense area of semi-arid but fertile plains to be irrigated by the water.

The lower Goulbourn River is subject to disastrous floods, and these would be abolished by building such a dam. Instead of dealing destruction and wholesale inconvenience, the millions of cubic feet of water which now pass down the river at flood time would be stored for the growing of wheat, lucerne, fruit, etc.

At the same time the water could be made to develop at least 10,000 H.P. continuously, and 20,000 H.P. for six months in the year, without any loss of water for irrigation purposes. It happens that lower down the river there already exists the Warranga dam, which would act as a balance reservoir, and during six months all the water needed to generate electric power could be stored in the Warranga basin, to be drawn from there during succeeding months. Mr. Elwood Mead has stated that 750,000 acres could be irrigated by water from Trawool and the annual value of the water would be about £375,000.

It will be noted that this scheme differs from that of the Cordoba Light and Power Co. in that the balance reservoir at Warranga could be used for the purpose of storing water passed down from the Trawool dam, so as to keep the power house at Trawool running all the year. The head of water at Trawool would thus vary, but the problem so far as the turbine generators are concerned is, of course, much less difficult than at Assuan.

(To be concluded.)

Temperature Cycles in Heat Engines.

By PROF. E. G. COKER and W. A. SCOBLE.

(Section G. Abstract.)

EXPERIMENTAL investigations of the cyclical variations of heat-engines and heat-pumps have received much attention, and numerous methods and instruments have been devised to give records of their cyclical changes, such as those of pressure and volume of the working fluid, changes of angular velocity of the crank-shaft, and the like. Temperature changes in the working fluid may usually be inferred very accurately from the pressures recorded on an indicator diagram, since there is usually a definite relation between pressure and temperature of a vapour, as, for example, in heat-engines using steam direct from a boiler without the intervention of a superheater. In other heat-engines, such as those using superheated fluids, and also those of the internal combustion type, the temperature is more difficult to determine, and it becomes important to measure it directly. Platinum resistance thermometers and thermo-electric couples have been frequently employed for measuring cyclical changes of temperature in heat-engines, and a complete record from point to point of a cycle may be obtained if the engine is working with absolute uniformity. As it is usually impossible to prevent some amount of variation in the working of the engine while the measurements are in progress, the resulting curve is a composite one, since each measurement corresponds to a different cycle.

The possibility of obtaining an instantaneous automatic record with an Einthoven type of galvanometer, was considered in our early experiments on the cyclical variations of temperature of the working fluid of a gas-engine, and in the walls of the cylinder, but the difficulties then appeared to be so great that a potentiometer balance method was used instead. Recently, by the kindness of the Cambridge Scientific Instrument Company, we have been able to make experiments with their latest form of short-period Einthoven galvanometer, and this has enabled us to obtain instantaneous records of the temperature-cycles of the working fluid of steam and gas-engines, and also the variations of temperature in the walls. Some of these photographic records are shown, and their detailed characteristics are considered in the paper. They confirm the general accuracy of our former measurements on cyclical variations of temperature in a gas-engine cylinder, and also show some new features due to variations from stroke to stroke caused by misfires and the like.

Irrigation Works in Italy.

By PROF. LUIGI LUIGGI, D.Sc., M.Inst.C.E.

(Section G. Abstract.)

AFTER showing that irrigation is the principal factor of the advanced state of agriculture, and the principal source of revenue for the Italian nation, the author describes the different ways of getting water for irrigation, and how it is distributed over the cultivated fields. When only small quantities are required, the water is generally raised from the subsoil, either by very primitive means, or by small but very modern centrifugal pumps driven by oil or electric motors, as in many parts of the valley of the Po, where hydro-electric plants are very common. The cost of the water raised electrically—especially during the daytime, when the electric current is distributed at lower rates than at night—varies from 4½d. to 11d. per 1,000 gallons, and it is considered very cheap, for if raised by animals, or worse still by men, its cost would be respectively eight to seventeen times higher.

For irrigation on a large scale resource is had to the rainfall, storing it up in reservoirs, or large artificial lakes of many million cubic mètres capacity. The water from these artificial lakes is generally used first for motive power—in some hydro-electric installations, which in Northern Italy are very plentiful—and this helps much in lowering the price of the irrigating water.

The State considers it as its duty to help all these undertakings. Irrigation puts under cultivation large tracts of land of very little value, and almost sterile, and part of the population can thus find useful employment in the cultivation of this land, otherwise nearly useless. Without irrigation Italy would not be able to feed two-thirds of its present population.

The Capacity of Radio-Telegraphic Aerials.

By PROF. G. W. O. HOWE, D.Sc.

(Section G. Abstract.)

THE capacity considered in this Paper is the actual static capacity, and not the equivalent capacity of the antenna considered as part of an oscillatory circuit. The accurate calculation of the capacity of a multiple-wire horizontal aerial with its leading-down wires would be a difficult mathematical problem, quite unwarranted by the practical requirements of radio-telegraphy.

When raised to a potential above or below that of the earth, the charge is distributed over the antenna in a way which is not easy to calculate, but which must be such that all parts of the antenna are at the same potential. If the antenna were made up of a great number of short pieces, placed end to end, but insulated from each other, it would be possible to distribute the charge uniformly, but the potential would then vary from point to point in a way which is easily calculated. If now we assume that all the separate pieces of wire are connected, electricity will flow from points of high to points of low potential until the potential is everywhere the same. The assumption made in developing the various formulæ is that this final uniform potential is equal to the average value of the potential when the charge was uniformly distributed. This is only approximately correct, but the accuracy is more than sufficient for all practical purposes. This method has been applied to antennæ of all the types usually employed, and formulæ have been established for each type. A large number of numerical examples have been worked out, and the results are given in tables and curves, so that the capacity of any antenna can be read off directly from its dimensions. The corrections due to the leading-down wires and to the proximity of the earth are fully considered, and examples given showing the application of the formulæ to antennæ of any type.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

TUNIS.—The Board of Trade recently issued particulars regarding a new revision of the Tariff of Tunis. The new rates were to come into force on July 1st; those applicable to electrical and similar goods are given below in so far as they have been altered :—

	Francs per 100 *kg.*
Celluloid and other similar plastic materials not specially mentioned—	
In cases, tubes and batons	75 (net)
In sheets, polished, coloured, or washed in any manner	150 „
Carbons for electricity and for other industrial uses weighing less than 3 kg. per piece	12 „
Weighing 3 kg. and more per piece	3
Stoneware pipes—	
Not enamelled nor varnished	·50
Enamelled or varnished	·65
Articles for electricity of porcelain, faience, white or coloured stoneware without parts of metal or other materials—	
Insulators, bell-shaped	5
Other—	
Weighing 100 grammes or more	7
Weighing less than 100 grammes and more than 10 grammes	10
Weighing 10 grammes and less	20
Articles for electricity of glass, without metal fittings,	
insulators, bell-shaped	5
Others, weighing 100 grammes or more	7
„ „ from 100 grammes to 10 grammes	10
„ „ 10 grammes and less	20
Articles for lighting purposes—	
Reflectors, shades, globes or various, of several colours decorated with gold or otherwise cut or engraved	16 (net)
Other	9 „
Incandescent electric lamps—	
With carbon filaments with mountings	80 (net)
With metallic „ „	150 „
Without mountings	250 „
Pipes and tubes of paper covered with bitumen	1
Transmission bands, muffled or of leather for machinery	60 (net

Sheets of india-rubber not vulcanised	20 (net)
Threads of vulcanised india-rubber—	
3 mm. or less in thickness	Free
Other	20 (net)
Sheets, plates, or slabs of vulcanised india-rubber mixed or not with other materials	16 (net)
Transmission belts	60 „
Manufactures of india-rubber not specially mentioned	70 „
Asbestos—	
Paper or cardboard	
In sheets (cut out or not) of rectangular form ...	6
Shaped, cut out in forms other than rectangular, with or without thread, cloth or metallic pieces	26 „
Threads, cords and plaits with or without other materials	20 „
Tissues	30 „
Other manufactures, with or without other materials	60 „
Mica in sheets or plates, mica wares, micanite and mica conglomerates, paper and cloth treated with mica ware combined with other materials	35 (net)

N.B.—Unless otherwise stated, duty is calculated on the gross weight of goods with packing.

25 francs = £1 ; kilog. = 2·204 lb.

CANADA.—The Canadian Government have recently made arrangements whereby the duty leviable in the Dominion on catalogues sent through the post may now be prepaid by the sender by affixing Canadian stamps to the wrappers. Formerly the duty has been demanded of the addressee, and this practice has often led to the non-delivery of catalogues. The stamps required can be obtained in denominations of one, two and five cents each, on application to the Commissioner of Customs, Ottawa, Canada, or to the Secretary, High Commissioner for Canada, 17, Victoria Street, London, S.W., on and after August 1st, 1914.

The duty stamps are to be affixed on each package for the amount of duty payable on the same.

The stamps should be affixed towards the upper left-hand corner of the parcel to be exported by mail, as the upper right-hand corner is usually reserved for postage stamps.

Packets bearing Customs duty stamps on arrival at the frontier port of Canada will be transferred to the Customs, to be checked for proper payment of duty and to have the Customs duty stamps thereon cancelled by marking same with the Customs dating stamp, or other cancellation stamp.

The articles specified in Tariff heading No. 178 comprise price lists, catalogues and other advertising matter, as follows, viz. :—

"Advertising pamphlets, advertising show cards, illustrated advertising periodicals; price books, catalogues and price lists; advertising almanacs and calendars; patent medicine or other advertising circulars, fly-sheets or pamphlets, advertising chromos, chromo-types, oleographs or like work produced by any process other than hand-painting or drawing, and having any advertisement or advertising matter printed, lithographed or stamped thereon, or attached thereto, including advertising bills, folders and posters, or other similar artistic work, lithographed, printed or stamped on paper or cardboard for business or advertisement purposes, not otherwise provided for" :—

Under the British Preferential Tariff ...	10 cents per lb.
„ General Tariff	15 „ „

The scale of duties payable in this manner for which stamps may be affixed has been fixed as follows :—

UNDER THE BRITISH PREFERENTIAL TARIFF.

Up to and including 1½ ounces	1 cent.
Over 1½ ounces and not exceeding 3¼ ounces ...	2 cents.
„ 3¼ „ „ „ 4¾ „ ...	3 „
„ 4¾ „ „ „ 6½ „ ...	4 „
„ 6½ „ „ „ 8 „ ...	5 „
„ 8 „ „ „ 9½ „ ...	6 „
„ 9½ „ „ „ 11¼ „ ...	7 „
„ 11¼ „ „ „ 12¾ „ ...	8 „
„ 12¾ „ „ „ 14½ „ ...	9 „
„ 14½ „ „ „ 16 „ ...	10 „

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,496. "Heater units for electrical gas meters." H. A. GILL. Aug. 10th. (Cutler Hammer Manufacturing Co., United States.) (Complete.)

18,497. "Relays for electric voltage regulators." BRITISH THOMSON-HOUSTON CO., LTD., A. P. YOUNG, and A. H. ST. C. WATSON. Aug. 10th

18,502. "Electrical switches." SIEMENS SCHUCKERTWERKE G.M.B.H. Aug. 10th. (Convention date, Nov. 22nd, 1913, Germany.) (Complete.)

18,504. "Electric igniting apparatus for gas burners." C. C. CARPENTER. Aug. 10th.

18,509. "Electric switches." B. P. SWYERS. Aug. 10th. (Complete.)

18,511. "Transmission of electrical impulses over circuits of high electrostatic capacity." G. MUSSO. Aug. 10th. (Addition to 17,246/14.) (Complete.)

18,519. "Electric tracks for vehicles." J. VILA. (Aug. 10th. (Complete.)

18,560. "Means for testing electric circuits." H. G. BURFORD. Aug 11th. (F. J. Agabeg, India.)

18,565. "Circuit arrangements for operating the selecting devices of telephone installations by number impulses." SIEMENS BROS. & Co., LTD. Aug. 11th. (Complete.)

18,566. "Incandescent lamps." ALLGEMEINE ELEKTRICITÄTS GES. Aug. 11th. (Convention date, Aug. 18th, 1913, Germany.) (Complete.)

18,598. "Electric starting and lighting systems as applied to motor cars and the like vehicles." W. H. EXLEY. Aug. 12th.

18,603. "Electric switching devices." H. S. HATFIELD. Aug. 12th.

18,607. "Attachments for telephones and the like." K. E. ZIERAU. Aug. 12th.

18,608. "Electric apparatus for ringing bells." L. M. J. D. DEL CASTILLO. Aug. 12th. (Convention date, Aug. 12th, 1913, Germany.) (Complete.)

18,611. "Protective devices for electric circuits." BRITISH-THOMSON HOUSTON CO., LTD. Aug. 12th. (General Electric Co., United States.)

18,660. "Electro-medical apparatus." H. W. COX & Co., LTD., and H. E. DONNITHORNE. Aug. 14th.

18,661. "Electric signalling systems particularly for use in mines." STERLING TELEPHONE & ELECTRIC CO., LTD., & J. W. DUNGEY. Aug. 14th. (Addition to 13,062/14.)

18,677. "Telegraphy." E. C. R. MARKS. Aug. 4th. (Delany Foreign Co., United States.) (Complete.)

18,685. "Electric resistances." BRITISH THOMSON HOUSTON CO., LTD. Aug. 14th. (General Electric Co., United States.)

18,692. "Electrical step-by-step mechanism." I. H. PARSONS & A. E. J. BALL. Aug. 15th.

18,705. "Automatic switchgear and apparatus for electro-dynamic brake circuits." H. V. JAMES. Aug. 15th.

18,707. "Process for banding projectiles." S. O. COWPER-COLES. Aug. 15th.

18,708. "Process for coating metallic surfaces with lead." S. O. COWPER-COLES. Aug. 15th.

18,711. "Wireless telegraphy." W. C. WOODLAND. Aug. 15th. (Complete.)

18,713. "Electric batteries" G. FULLER, G. J. A FULLER, & L. FULLER. Aug. 15th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

16,840. CHANGE-OVER ELECTRIC SWITCHES. H. H. Berry and W. J. Markham. July 22nd.

16,841. COMBINED ELECTRIC SWITCHES AND PLUGS. H. H. Berry and W. J. Markham. July 22nd.

17,038. TELEPHONE SYSTEMS. K. E. Ericsson and G. W. Dahlström. July 24th. (July 26th, 1912.)

17,417. CIRCUIT ARRANGEMENTS FOR TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. July 29th. (July 30th, 1912. Addition to 10,685/13.)

17,480. MAGNET CORE FOR USE IN FERRARIS ELECTRICITY METERS. Landis and Gyr Ges. July 30th. (July 31st, 1912.)

17,583. OIL HIGH-TENSION ELECTRICAL SWITCHES. Akt. Ges. Brown, Boveri, et Cie. July 31st. (Aug. 19th, 1912.)

17,859. WIRELESS SIGNALLING. R. C. Galletti. Aug. 5th.

18,166. MEANS FOR DETECTING INFLAMMABLE GASES, ESPECIALLY ADAPTED FOR USE IN MINES. J. W. Manley & W. J. L. Sandy. Aug. 9th.

18,907. DYNAMO-ELECTRIC MACHINERY, AND CONDUCTORS THEREFOR. Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. Aug. 20th.

20,230. ELECTRIC LIGHTING AND STARTING OF MOTOR ROAD VEHICLES AND OTHER MOTOR DRIVEN BODIES. C. E. Sims. Sept. 8th.

20,684. TIME DIALS FOR RAILWAY AND LIKE SIGNALLING. National Electric Time Co. & H. B. Swift. Sept. 13th.

21,193. COUNTER-WEIGHTS FOR PENDANT ELECTRIC LIGHT FITTINGS. J. M. Doughty & G. H. Gyton. Sept. 19th.

22,458. EAR CAPS FOR USE IN TELEPHONING. J. C. McGowan. Oct. 6th.

23,452. SHADE-SUPPORTING DEVICES. E. C. R. Marks. (Benjamin Electric Manufacturing Co.) Oct. 16th.

26,592. ELECTRIC HAND-LAMPS. A. Schrader. Nov. 19th.

26,646. VOLTAGE AND OUTPUT REGULATORS FOR DYNAMO-ELECTRIC MACHINES. T. Ferguson & J. R. Johnstone. Nov. 20th.

26,764. FITTINGS FOR ELECTRICAL CONDUITS AND METHOD OF MANUFACTURING THE SAME. J. R. A. Hemming. Nov. 21st.

27,746. COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES. H. Mensforth. Dec. 2nd.

1914.

560. PROCESS FOR STARTING INTERNAL-COMBUSTION ENGINES. R. Bosch (firm of). Jan. 8th. (April 26th, 1913.)

1,550. MANUFACTURE OF REDUCTION PRODUCTS OF SULPHUROUS ACID AND SALTS THEREOF. Chemische Fabrik Griesheim-Elektron. Jan. 20th. (May 2nd, 1913.)

2,408. ARRANGEMENTS FOR LOADING ELECTRIC INDUCTION FREQUENCY CONVERTERS. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) Jan. 29th.

4,356. WATT-HOUR INDICATING MAGNET MOTOR METER. Allgemeine Elektricitats Ges. Feb. 19th. (March 11th. 1913.)

5,514. STARTERS FOR ELECTRIC MOTORS. Siemens Bros. Dynamo Works & E. Schupp. March 4th.

6,628. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE INSTALLATIONS. Siemens & Halske Akt. Ges. March 16th. (June 18th, 1913.)

7,437. APPARATUS FOR WINDING LAPPINGS, WIRES, OR THE LIKE, UPON RING-SHAPED COILS OR OTHER BODIES OF SIMILAR SHAPE. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) March 24th.

7,685. CONTACTS FOR ELECTRIC SWITCHES. R. Bosch (firm of). March 26th. (Feb. 21st, 1914.)

8,025. APPARATUS FOR ACTUATING VALVES, SWITCHES, OR THE LIKE AT PREDETERMINED TIMES. A. C. Frost and A. C. Wright. March 30th.

8,711. STARTING OF ROTARY CONVERTERS. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) April 6th.

8,814. ELECTRICALLY-HEATED INSTRUMENTS. J. A. Chapman. April 7th. (May 6th. 1913.)

8,889. MOTOR-STARTING SWITCHES, RHEOSTATS, AND THE LIKE. Siemens Bros. Dynamo Works, Ltd., & E. Schupp. April 8th.

10,170. ELECTRIC INCANDESCENT LAMPS. C. Ficq. April 24th.

11,309. SUPPORTS FOR OVERHEAD CONDUCTORS FOR ELECTRIC RAILWAYS. British Westinghouse Electric & Manufacturing Co., Ltd. (Westinghouse Electric & Manufacturing Co.) May 7th.